VETERINARY MEDICINE

A Monthly Magazine Devoted to the Promotion of the Art and Science of Veterinary Medicine

Vol. XLV JUNE 1950 No. 6

Published Monthly by the

VETERINARY MAGAZINE CORPORATION

Suite 803, Livestock Exchange Building
Kansas City 15, Missouri, U.S.A.
Telephone: Victor 2985

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Entered as second class matter at the post office at Kansas City, Missouri. Entered as second class matter under the title of the American Journal of Veterinary Medicine, July 19, 1910, at Chicago, Illinois, under the Act of March 3, 1879.

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The Treatment Of Bovine Pyelonephritis*

ERSKINE V. MORSE, D.V.M., Ph.D.,** Madison, Wisconsin

DURING the past ten years, a number of authors have reported on the treatment of bovine infectious cystitis and pyelonephritis caused by the bacterium, *Corynebacterium renale*. Before the advent of the sulfonamide drugs and various antibiotics, little could be offered in the nature of specific therapeutic measures. It is the purpose of this paper to review briefly and to attempt to evaluate both the published and some unpublished data pertaining to the treatment of this disease.

Addition to our knowledge of *C. renale* infection and the development of effective remedial measures have been somewhat hampered in the past by the lack of suitable experimental animals other than cattle. Because of the cost of cows and of the difficulty frequently encountered in infecting them, adequate therapeutic studies have been few. Recent evidence indicates that white laboratory mice[1] and rabbits[2] are susceptible to *C. renale* infection, and that the disease in these animals closely resembles that seen in cattle. Lovell and Cotchin[3] have already reported upon the beneficial therapeutic effect of penicillin in induced pyelonephritis in the mouse. It is hoped that more investigations on the efficacy of our newer drugs will be conducted now that relatively inexpensive experimental hosts are available.

The evaluation of therapeutic measures is usually difficult and reports of purported success should be studied critically. With the exception of the experiments of Lovell and Cotchin[3] the reports on the treatment of pyelonephritis deal with naturally infected cattle. In surveying these data it should be remembered that the following facts apply to the disease in cattle: (1) Spontaneous recoveries in naturally infected cows may occur; (2) after apparent recovery, relapses frequently occur; (3) the pathological changes are such that complete repair is impossible; (4) the etiological agent, *C. renale*, is difficult to eliminate from the renal tissues; and (5) the disappearance of blood clots, tissue debris and blood from the urine does not necessarily constitute a recovery. The post-treatment observational interval should include the following lactation period. Cases have been observed which made apparently phenomenonal recoveries but which died within a few months following the next pregnancy. Under such circumstances, one does have the advantage of securing calves from valuable cows; however, these patients may not be classified as having recovered.

Symptomatic Treatment

The symptoms of pyelonephritis are classical and need not be described here. It is little wonder that early treatments were of a symptomatic nature. The improvement noted was seldom more than transitory. Pyelonephritis is a specific infection, and therefore therapeutic measures must, of necessity, aim at the elimination of *C. renale* from the host. Symptomatic measures, such as the intravenous administration of saline and dextrose solutions, are certainly indicated in many cases. However, the successful treatment of pyelonephritis depends more upon specific measures than upon those of a purely symptomatic nature.

Udall[4] recommended sodium monobasic phosphate, NaH_2PO_4, in an attempt to render the urine acid. Unfortunately, 4 oz. or 125 gm. daily does not usually accomplish this effect and observed improvements generally prove only temporary. Fox[5] cited one of his cases which received such treatment and was studied for two years. The animal had repeated attacks of pyelonephritis during the observational period. It should be noted that a pH of 6.0 is moderately inhibitory to *C. renale*, while at pH 5.0 growth *in vitro* is markedly suppressed[6].

Roberts[7] also attempted to decrease the urine alkalinity. Chlorethamine (Pitman-Moore), given orally, was the compound investigated. A seven-year-old, 800-pound Guernsey cow suffering from pyelonephritis was given 100 gm. in the evening and the same quantity the following morning. The reaction of the urine gradually dropped during three days from pH 8.2 to pH 6.2. The animal died three days after treatment was initiated. Another infected cow, a 1,100-pound Holstein, was given 160 gm. on November 17; 190 gm. on November

*Published with the approval of the Director of the Wisconsin Agricultural Experiment Station, Madison.

**Department of Veterinary Science, University of Wisconsin.

18; 300 gm. on November 19 and 675 gm. on November 20. A small, unspecified amount of penicillin was also administered. During this time the general condition and appearance of the animal became progressively grave. The reaction of the urine was pH 6.0 on November 20. Bacteriological examination of the urine was negative for *C. renale*. On November 28, the cow aborted a four-month-old fetus; the pH of the urine at this time was 8.2. An apparent recovery from the infection was made, no relapses have been observed, and the cow is now in apparently good health more than one year after treatment. The apparent hazards of the treatment have discouraged Roberts from employing chlorethamine in other cases of the natural disease.

Transfusions of oxalated or citrated blood have been employed without altering the outcome of the disease[9]. Dextrose, saline and calcium gluconate by the intravenous route[9] were indicated for some patients, but, like blood transfusions, they should be considered only as adjuvants and given in conjunction with specific therapy.

Specific Therapy

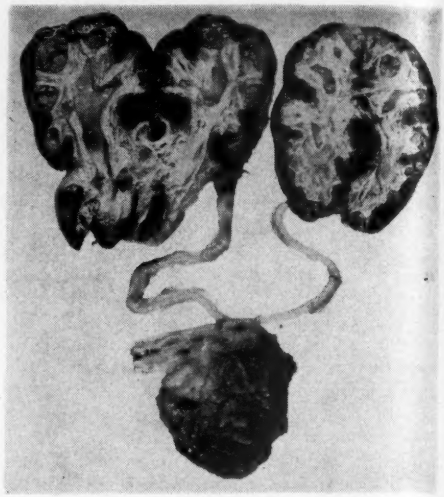
Specific therapy is designed to combat and aid in the elimination of the invading pathogen. Sulfonamide drugs and penicillin have been employed in the treatment of pyelonephritis. Penicillin has given the most promising results although it has not proved effective in a number of cases. Roberts[18] feels that after the ureters of an infected cow attain ⅜ inches in diameter, treatment is rather unsuccessful.

Udall[19] mentioned the use of azamine or pyridium as being of value in the early treatment of pyelonephritis. The details for the use of this dye were not given. One practitioner, known to us, prescribed 1 oz. in water to be given orally twice daily for six days. The results were not encouraging.

Mahler[8] reported failure in the treatment of a case with sulfanilamide. The animal weighed 1,600 pounds and received 1,500 gr. of the drug daily for nine days.

The writer observed the results of treatment of two patients in which sulfonamide therapy was used. One cow, a 900-pound Guernsey, received 10 gm. of sulfanilamide *per os* daily for ten days. No permanent improvement was noted. Another animal, a nine-year-old Holstein, was given a 25% solution of sulfamethazine intravenously. She received 500 cc. daily for five successive days, and 250 cc. for the next five days. An examination five months later disclosed the patient to be in good health and pregnant. However, large numbers of *C. renale* were still present in the urine. Unfortunately, the opportunity for further examinations was not possible, and the final outcome of the case is unknown.

McLaughlin[11] observed a case which was treated with sulfapyridine solutions intravenously, sulfanilamide orally and aqueous solutions of penicillin intramuscularly. The penicillin dosage would appear rather low in the light of our present knowledge, since 200,000 to 600,000 international units (I.U.) per day were employed. The sulfonamide drugs were administered at what would be considered fairly adequate levels. It is possible that a synergistic action of penicillin with the sulfanilamide and sulfapyridine was responsible for the apparent recovery which followed. The author reported the animal in good condition and milking well nine months after the cessation of therapy. No urine culture was made.



Courtesy of the Cornell Veterinarian

Gross pathological changes of pyelonephritis. In the case illustrated, infection was not a specific C. *renale* pyelonephritis inasmuch as B. *coli* was isolated from the bladder, but not the kidneys. The gross lesions are typical of advanced C. *renale* infection.

In England, Lovell and Cotchin[9] attempted penicillin therapy in artificially infected mice. Their results indicated that early treatment is the keystone of success. The majority of their cultures of *C. renale* were sensitive to 0.001 I.U. or less of penicillin *in vitro*. Most strains of the organism isolated in the eastern United States showed a similar sensitivity[9].

In an early report, Beck, DeMott and Boucher[12] gave the results of penicillin therapy

in bovine pyelonephritis. Six cows were injected intramuscularly every four hours with a saline penicillin solution containing 300,000 I.U. The treatment was continued until 10,000,000 I.U. were given. All animals improved clinically. The authors concluded that three animals made apparently complete recoveries.

Fox[5] treated four infected cows with penicillin. One recovered after receiving penicillin in oil and beeswax intramuscularly. This animal was treated with at least 1,000,000 I.U. for seven days of a nine day period, while 600,000 and 500,000 units were given on the other days. Fifteen months after treatment the animal was in good health, and cultures of the urine were negative for *C. renale*. The other three cases were given aqueous penicillin preparations. Frequent intramuscular injections of 100,000 to 200,000 I.U. were made until 3,000,000 to 10,000,000 units had been administered. Two of these three remaining cases went to slaughter, and evidence of active pyelonephritis was detected. The third patient, one year later, was thin; the milk flow continued, but the urine was still positive "by all tests for pyelonephritis," according to the author.

Kiesel, *et al.*,[13] observed seven cases of bovine pyelonephritis, six of which received intramuscular injections of penicillin in oil and beeswax, and one in which the subcutaneous route was employed. One million units were given daily for ten days to five animals and for nine days to the sixth patient. The seventh case received 1,500,000 units for ten days. Four apparent recoveries, one questionable recovery and two failures were reported. The authors stressed that apparently recovered animals should be observed over long periods to determine their ultimate status. The treatment of purebred cattle was deemed economically sound.

Continued observations[14] were made on three of the four patients reported as apparent recoveries by Kiesel, *et al.*[14]. One animal was negative on bacteriological examination and was in good health 13 months after treatment. The other two were milking well and normal, but both were shedding organisms in their urine 15 months after treatment.

Since 1,000,000 units of penicillin in oil and beeswax had produced uncertain recoveries, larger dosages of the preparation were employed by Roberts in a series of pyelonephritis cases[15]. Two or 3,000,000 units were given in either single or divided doses daily for ten days. Some of the patients received the penicillin at this level for five days and 1,500,000 units daily for five more days. The results[15] were more encouraging than those observed when only 1,000,000 units were administered for the ten-day period. Early detection of the infected animals and immediate treatment again appeared to be of paramount importance. However, it is felt more data should be collected in order to evaluate these findings.

Arthur,[16] in England, gave a report of the outcome of 11 pyelonephritis cases treated with intramuscular injections of an aqueous penicillin solution. Although various dosage levels were employed, most of the cows were given 300,000 units three times daily with 1,000,000 units being given late each night. Treatment was continued until a total of 6,000,000 to 10,000,000 units had been administered. The investigator reported that five animals were normal 22 months after treatment. Three cases showed temporary recovery followed by a relapse, and three patients were uninfluenced. Recommendations were made that 2,000,000 units per day be given until a total of 6,000,000 to 10,000,000 units had been administered. The therapy was concluded to be economically sound.

Merriman[17] has described the successful treatment of a pyleonephritis case using procaine penicillin. The cow received a single injection of 1,000,000 units the first day. The second day 400,000 units were given twice, and on the third and fourth days 400,000 units were given once daily. Merriman proposed that 1,000,000 units be given every 48 hours until a total of 3,000,000 units had been administered.

The penicillin blood levels observed with procaine penicillin are much the same as attained using penicillin in oil and beeswax[18]. One million units of the latter product daily for ten days did not give as successful results as had been anticipated[14]. Therefore, the advisability of employing considerably less penicillin as proposed by Merriman should be seriously questioned.

Procaine penicillin in peanut oil containing 2% aluminum monostearate appears to offer the practitioner the most satisfactory product at present in therapy for pyelonephritis. Blood and urinary penicillin levels are usually observed for 72 hours when 3,000,000 units are administered by the intramuscular route[18]. It is recommended that this dosage be given three times at 72-hour intervals. There are few cows whose worth will not justify the price of such treatment.

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Summary

A number of treatments for bovine pyelonephritis have been described and reviewed. Most of the measures, until the advent of penicillin, were of questionable value. A number of factors enter into the successful treatment of this disease, and their consideration is well warranted.

The early detection and treatment of the infected animals appears to be the keystone of successful therapy. Advanced cases respond only temporarily and usually suffer at least one relapse even when under the best regimen of treatment.

Symptomatic treatment alone, employing dextrose, saline, blood transfusions, are ineffective measures. However, adjuvant measures should not be overlooked in conjunction with specific therapy. The chosen line of such measures will depend upon the individual case under consideration.

The various sulfonamide drugs have not shown much promise when employed as the sole therapy. Their use may be indicated when employed in conjunction with an antibiotic such as penicillin.

Penicillin offers the most encouraging results in the treatment of pyelonephritis. Doses of 2,000,000 to 3,000,000 units have been advocated as an adequate amount by most investigators. The frequency of administration and division of this unitage depend upon the particular preparation chosen. Most authors recommend that a total of approximately 10,000,000 units be employed for each animal. It is felt that the therapy period should cover an interval of about ten days.

Clinically recovered patients should be examined at intervals of six months for 18 months or more to determine whether recovery is permanent. The physical condition of the animal during the first lactation period following treatment will often serve as a clue to the possible extent of recovery.

REFERENCES

1. Lovell, R., and Cotchin, E., Studies on *Corynebacterium renale*. II. The Experimental Pathogenicity for Mice. *Jour. Comp. Path. & Ther.*, 56:205, 1946.
2. Feenstra, E. S., Thorp, F., Jr., and Gray, M. L., Pathogenicity of *Corynebacterium renale* for Rabbits. *Am. Jour. Vet. Res.*, 10:12, 1949.
3. Lovell, R., and Cotchin, E., Studies on *Corynebacterium renale*. III Penicillin Treatment of Experimentally Infected Mice. *Jour. Comp. Path. & Ther.*, 57:22, 1947.
4. Udall, D. H., The Practice of Veterinary Medicine, ed. 5, Ithaca, N. Y., published by the author, 1947, pp. 258:259.
5. Fox, F. H., Treatment of Four Cases of Bovine Pyelonephritis with Penicillin. *Cornell Vet.*, 37:59, 1947.
6. Morse, E. V., Bovine Pyelonephritis. *Cornell Vet.*, 38:135, 1948.
7. Roberts, S. J., N. Y. State Veterinary College. Personal communication, Jan. 1950.
8. Mahler, E. J., Pyelonephritis in a Cow. *Vet. Med.*, 37:434, 1942.
9. Olney, R., Pyelonephritis in a Holstein-Friesian Cow. *Vet. Med.*, 38:397, 1943.
10. Udall, D. H., The Practice of Veterinary Medicine, ed. 3, Ithaca, N. Y., published by the author, 1939, p. 219.
11. McLaughlin, A. R., Pyelonephritis—An Apparent Recovery. *Vet. Med.*, 42:351, 1947.
12. Beck, J. D., De Mott, T., and Boucher, W. B., A Report of Six Cows with Infectious Cystitis and Pyelonephritis Treated with Penicillin. *Univ. Pa. Vet. Ext. Quart.*, 100:10, 1945.
13. Kiesel, G. K., Morse, E. V., and Evans, W. M., Treatment with Penicillin of Pyelonephritis in Cattle. *Cornell Vet.*, 37: 371, 1947.
14. Morse, E. V., Pyelonephritis. IV. Physiological and Bacteriological Studies of Eight Cases of Pyelonephritis Treated with Penicillin. *Cornell Vet.*, 38:273, 1948.
15. Roberts, S. J., N. Y. State Veterinary College. Unpublished data, 1948.
16. Arthur, G. H., Some Observations on Bovine Pyelonephritis and Its Treatment with Penicillin. *Vet. Rec.*, 61:257, 1949.
17. Merriman, G. M., Economic Practicability of Treating a Case of Bovine Pyelonephritis. *N. Am. Vet.*, 30:171, 1949.
18. Morse, E. V., The Response of Cattle to Penicillin Preparations Following Intramuscular Injection. *Am. Jour. Vet. Res.*, 10:314, 1949.

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Medical Genius

Galen was born about 130 A.D., the son of an architect, from whom he inherited a considerable fortune. So great was the impress of his learning and genius that for a thousand years to question his teaching was medical heresy and for 13 centuries this teaching dominated medical thought throughout Europe.

Although Galen never dissected a human subject nor saw one dissected, the first modern anatomies were based upon his work and our present day anatomical nomenclature is essentially his.

Galen is the undisputed father of experimental physiology, the basis of modern medicine. Many of the vegetable drugs of today were introduced by him and pharmacists still call fluid extracts, tincture, and decoctions of vegetable drugs, galenicals.

Galen began writing at 13 and continued to write till his death at the age of 70. His medical writings constitute 20 large volumes—D.M.C.

▼ ▼ ▼

Leopards like the meat of domestic dogs and cattle.

The Use Of Hyaluronidase With Calcium Gluconate Medication In Sheep*

D. F. EVELETH, D.V.M., Ph.D., GLENN C. HOLM, M.S., D.V.M., and F. M. BOLIN, D.V.M.,
Fargo, North Dakota.

Hyaluronidase is a new enzyme designed to aid diffusion in hypodermoclysis.

Controlled studies reported herein illustrate the practicability of this agent in relieving untoward symptoms that are common sequelae to the injection of large quantities of parenteral solutions when given subcutaneously or intramuscularly.

Hyaluronidase gives promise of valuable use in veterinary medicine because of its aid to diffusion of medicinal agents, and its potential in other unrelated procedures.

INTRAVENOUS medication is an accepted method for dosing many species of animals, including man. The injection of a concentrated solution of any type into the blood stream creates disturbance in the ionic equlibrium which may be severe enough to produce symptoms of shock and which may cause death of the patient. Therefore, some practitioners prefer to medicate animals by intramuscular or subcutaneous injections. In cases where large amounts of fluid are injected intramuscularly or subcutaneously, there develop areas of soreness with induration at the site of injection.

The purpose of this paper is to bring to the veterinarian's attention an enzyme (Hyaluronidase**) which, when added to calcium gluconate or similar solutions, causes their rapid diffusion when injected into the tissue without objectionable features mentioned above.

Hyaluronidase has been used extensively in human medicine to aid in the rapid distribution of medicinal agents injected either subcutaneously or intramuscularly. This enzyme breaks down the hyaluronic acid which forms a portion of the material in the interstices of the tissue. When the hyaluronic acid is no longer a barrier in the tissues, injected fluids are rapidly absorbed and no pressure develops.

Experimental Trials

Sheep were chosen for comparative tests by intravenous, intramuscular and subcutaneous injections with and without hyaluronidase in the injected fluids. A solution of calcium gluconate and glucose and other ingredients was chosen for the test solution because previous experience had indicated that this material frequently caused shock when given to sheep by the intravenous method.

The solution used contained; calcium 12.42 gm. (equivalent to 141.22 gm. calcium gluconate), magnesium 2.76 gm., phosphorus 7.09 gm., dextrose, C. P. (anhydrous) 75.0 gm. and distilled water, q.s. 500 cc.

The dose was 1 cc. solution per pound of body weight of the sheep in all cases except the two sheep injected intravenously. In each of these cases the sheep developed symptoms of shock and the injections were discontinued. The dose for sheep no. 956 was .375 cc. per pound and for sheep no. 961 was .627 cc. per pound body weight. In those cases where hyaluronidase was used 150 T.R. units were incorporated in the dose of calcium gluconate used.

In all cases except the intravenous injections, the solutions were allowed to flow into the tissues as rapidly as possible from a bottle held about 18 inches above the site of the injection. Blood samples were taken at different intervals and the calcium content of the serum determined (Kramer-Tisdall method). The results of these experiments are summarized in table 1.

Post-injection examination of the sheep indicated that where hyaluronidase was used there was little or no soreness or induration. Where hyaluronidase was not used the tissues were swollen and painful (see figs. 1 and 2).

The injection times were always longer in

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**Hyaluronidase, (Hydase, Wyeth Inc.) is packaged as a sterile desiccated powder which may be dissolved by injecting 1 cc. of sterile saline into the vial and transferring the resulting solution to the fluid to be injected into the patient.

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Fig. 1. Results of a subcutaneous injection of calcium gluconate solution, with added dye, 2.5 hours after administration to sheep. Note severely congested area and the limitations of the diffusion of injected material.

Fig. 2. Results of subcutaneous injection of a like quantity of calcium gluconate, with dye, to which hyaluronidase has been added. Note diffusion of material. All factors that might influence the diffusion area or rate were kept constant in experimental trials. Unretouched photographs show actual appearance of tissue 2.5 hours following administration of the solution to sheep.

paired comparisons when hyaluronidase was not used. In comparing the serum calcium levels one to two hours after injection, it can be noted that where the hyaluronidase had been used, the serum calcium levels were higher than those in which no hyaluronidase was used. There also appears to be a more rapid loss of serum calcium as shown by the calcium levels at the five to six hour post-injection observations.

Pregnancy Toxemia

A pregnant four-year-old ewe was presented for diagnosis February 9. The ewe exhibited the typical symptoms of pregnancy disease. She ground her teeth, had difficulty in standing and was indifferent to various types of stimuli. The urine was positive to Rothera's test for ketone bodies.

TABLE 1—SERUM CALCIUM LEVELS AFTER DIFFERENT METHODS OF INJECTION

Sheep Number	956	961	957	954	A214	955	953	958	959	960
Method of Injection	IV	IV	IM	IM	IMH	IMH	S	S	SH	SH
Duration of Injection (min.)	4	20	13	12	4	8	11	5	5	3
Time after Injection (hr.)	Milligrams Ca. per 100 cc. serum									
0	11.1	10.4	11.2	9.4	5.9	9.7	10.6	10.9	11.3	9.4
¼-¾	15.6	19.7	11.8	12.4	6.9	12.7	12.6	10.4	15.3	11.1
1-2	13.1	15.3		15.0		17.5	12.1		19.5	
2-3			15.0		11.8					
3-4		13.7						14.6		14.6
4-5										
5-6			12.9		10.1		10.8	14.9	14.2	12.0
17-18	10.4			10.1		10.3				
20-24		9.8	10.0		5.5		10.3	10.8	10.4	10.2

Key: IV—Intravenous IM—Intramuscular IMH—Intramuscular with hyaluronidase S—Subcutaneous SH-Subcutaneous with hyaluronidase

The ewe was given an intramuscular injection of 100 cc. of calcium gluconate with glucose, to which had been added 150 units of hyaluronidase. Twin fetuses were removed by cesarean section under local anesthesia. Within 18 hours the ewe was eating and drinking and subsequently made an uneventful recovery. The serum calcium and vitamin A content of the ewe's blood before medication were 9.94 mg./100 cc. and 93 I.U./100 cc., respectively. Since there was no hypocalcemia, it may be assumed that the glucose was of more benefit to the patient than was the calcium. Unfortunately no blood sugar determinations were made in this case.

Summary

The injection of a glucose-calcium gluconate solution containing hyaluronidase intramuscularly and subcutaneously into sheep was followed by rapid absorption. These findings are of such a nature it is suggested that this method of therapy may be employed in any cases of ketosis or hypocalcemia of sheep, cattle, or other species.

Acknowledgment

The authors wish to thank Wyeth Incorporated, Philadelphia, Pa., for furnishing the hyaluronidase (hydase) used in these experiments.

Thanks are also due Dr. D. W. Bolin, Associate Nutritionist of the North Dakota Agricultural Experiment Station, for assistance in making the calcium determinations.

▼ ▼ ▼

Identification of Horseflesh

Recent publicity and reports of legal action against meat dealers in several mid-western cities for alleged sale of horseflesh for beef have focused some attention on methods of differentiation of small pieces of the muscle and fat of horses and cattle.

Identification is often extremely difficult, particularly when meat is ground or in mixed sausage form. Horseflesh is similar to beef in appearance (color) when freshly killed, but the former rapidly acquires a characteristic brown color noticeable either as raw or cooked meat. Texture and fat may make differentiation quite simple in roast or steak, in most instances, but is not altogether dependable in others. The odor of horseflesh may resemble linseed oil due to the high linolenic acid contents of the fat on which at least one chemical test for adulteration is based. A sweetish aroma may be noted on roasting or boiling. The taste after cooking is sweetish.

Chemical and biological tests may be required before positive deductions can be made. The chemical test is based on glycogen content of horseflesh, which is much greater than in beef. Biological and serological tests employed include the precipitation, complement-fixation and anaphylactic test. Biological tests are useful primarily to test sausage samples for adulteration.

▼ ▼ ▼

Necrotic Stomatitis in Baby Pigs

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Necrotic stomatitis is a disease of young pigs, characterized by inflammation and necrosis of the gums, mouth and face. *Bacillus necrophorus* is the causative agent and injury the avenue of infection.

The affection usually begins at the margin of the gums. Large eroded areas later form and the lips and face also become affected.

It is a common opinion that the little black teeth of baby pigs commonly cause injury. Pigs injure each other with these teeth and infection may develop. If these teeth are nipped off one should be careful not to injure the gums and thus form an avenue of infection.

Symptoms of Infection

Pigs attempt to nurse but because of sensitive gums they obtain little nourishment. There is an offensive odor noted about the head. The disease may also be transmitted to the teats and udder of the mother by nursing. The course of the disease varies from a few days, in the acute form, to several weeks in the chronic form. Lesions may be noted around the feet and other parts of the body where injuries have occurred and become infected.

Treatment

Sanitation is important. Sodium sulfapyridine solution, intraperitoneally, has been helpful in many trials. Dosage recommended is 1 gr. per pound body weight, repeated in 24 hours. In addition, affected parts may be dipped in 1% copper sulfate solution. Usually one dipping is enough, but may be repeated. The premises should be thoroughly cleaned and disinfected. Pigs should be moved to clean ground.

▼ ▼ ▼

Antibacterial agents are useful to prevent infection in wounds and thereby aid only indirectly in wound healing.

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Blood Pictures Of Lactating And Non-lactating Thoroughbred Mares*

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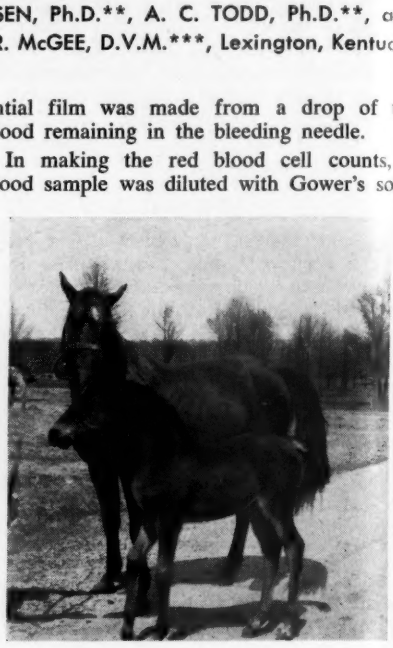
VETERINARIANS and horsemen in central Kentucky have reported frequently that Thoroughbred mares nursing foals show a "suckled down" condition characterized by a loss in flesh. Older mares and particularly good milking mares are more prone to show this condition. A large percentage of broodmares in the Bluegrass Region, of course, are in foal and at the same time are nursing sucklings from a previous pregnancy. Where such mares are "suckled down," they would appear not to be capable of providing an ideal physiological environment for their developing fetuses.

The present study was initiated to determine whether the blood picture of a Thoroughbred mare is influenced by lactation. The blood picture of 17 Thoroughbred lactating mares was compared with the blood picture of 17 Thoroughbred non-lactating mares. Of the 17 lactating mares, three were barren and 14 were in the early stages of pregnancy (two to three months). Of the 17 non-lactating mares, 12 were barren and five were in the early stages of pregnancy.

Methods

Both lactating mares and non-lactating mares in good physical condition were selected in approximately equal numbers from each of two farms. The blood samples from the mares on both farms were taken within one week. The blood samples were collected under as nearly identical conditions as possible with respect to time of day, time of feeding, watering, length of time in stall before they were bled, and the degree of excitement experienced during the bleeding. Five ml. of blood were collected from the jugular vein in a bleeding tube containing 1.3 mg. ammonium and 0.7 mg. potassium oxalate per ml. The differential film was made from a drop of the blood remaining in the bleeding needle.

In making the red blood cell counts, a blood sample was diluted with Gower's solu-



tion in a red blood cell diluting pipette; a Spencer bright-line hemacytometer was used. The counts on each horse were done in duplicate and had to be within 500,000 cells/cmm. of each other. Counts which came within this limit were averaged and recorded. Counts which were outside the stated limit were repeated until the stated limit was achieved.

Duplicate leukocyte counts were also done. The two separate counts had to be within 1,000 cells/cmm. of each other before they were averaged and recorded.

Hemoglobin concentrations were measured by means of the Fisher Electro-Hemometer.

Wintrobe's hematocrit tubes were used for the determination of the volume of packed erythrocytes; the hematocrits were centrifuged for one-half hour at 3,000 r.p.m.

Results

The non-lactating mares on the two farms showed consistently higher average blood

*The investigation reported in this paper is in connection with a project of the Kentucky Agricultural Experiment Station and is published by permission of the director.

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values than did the lactating mares. (Table 1) The following average blood values of nine non-lactating mares at the first farm were recorded: erythrocytes, 9,400,000/cmm.; hemoglobin, 13.18 gm./100 ml.; leukocytes 9,800/cmm.; packed volume of erythrocytes 41.7%. The average blood values of seven lactating mares on this same farm were: erythrocytes, 8,410,000/cmm.; hemoglobin, 12.05 gm./100ml.; leukocytes 8,900/cmm.; packed volume of erythrocytes, 36.4%. At the second farm, the eight non-lactating mares examined showed the following average blood values: erythrocytes, 10,000,000/cmm.; hemoglobin, 13.87 gm./100ml.; leukocytes, 11,900/cmm.; packed volume of erythrocytes, 42.2%. The ten lactating mares on this farm showed the following average blood values: erythrocytes, 8,500,000/cmm.; hemoglobin, 12.33 gm./100 ml.; leukocytes, 8,800/cmm.; packed volume of erythrocytes, 36.6%.

The ranges, arithmetic means and their standard errors, and the standard deviations for the blood values of the 17 Thoroughbred non-lactating mares and the 17 Thoroughbred lactating mares used in this study are summarized in tables 1 and 2.

The differences between the mean erythrocyte counts and hemoglobin values of non-lactating mares and lactating mares were found to be highly significant upon statistical analysis. The difference between the mean leukocyte counts in these two categories of mares was found to be significant only at the 5% level.

Discussion

The methods of feeding the lactating and non-lactating mares at the two farms used in this study were similar. Lactating mares were given a supplemental ration of clover, oats, or a commercial supplement. The non-lactating mares were maintained on pasture only. Even though the lactating mares were on a supplemental diet, their average erythrocyte count, hemoglobin content, and packed volume of erythrocytes were below the averages reported for the non-lactating mares.

The mean corpuscular volume and mean corpuscular hemoglobin concentration of the two categories of horses are very similar. The lower average erythrocyte count, hemoglobin content, and volume of packed erythrocytes in lactating mares, therefore, is due to fewer circulating erythrocytes and not to a hypochromic condition or to a reduction in the size of the erythrocytes.

Even though statistical analysis indicates a significant difference between the mean leukocyte counts of the two categories of mares, a definite conclusion would be unwarranted in view of the fact that conditions causing a mild leukocytosis or leukopenia are frequently not overtly expressed in the general physical condition of the horse. The differential counts of the two categories of mares are similar.

TABLE 1. BLOOD PICTURE OF 17 NON-LACTATING MARES AND 17 LACTATING MARES ON TWO FARMS IN CENTRAL KENTUCKY FROM JULY 11 TO 19, 1949.

Measure	Erythrocytes 10^6/cmm.	Hemoglobin gm./100ml.	Packed volume of erythrocytes %	Leukocytes 10^3/cmm.	Mean corpuscular volume cubic microns	Mean corpuscular hemoglobin concentration %
Non-Lactating Mares						
Range	7.04—10.94	11.0—15.9	36.8—49.0	7.25—14.00	37.0—54.7	29.3—34.8
Arithmetic mean and standard error	9.69 ±0.278	13.5 ±0.320	42.0 ±0.845	10.8 ±0.489	43.7 ±0.944	32.1 ±0.302
Standard deviation	1.150	1.322	3.486	2.017	3.894	1.246
Lactating Mares						
Range	7.46—9.56	10.3—14.2	32.0—44.8	7.45—11.70	41.7—47.6	31.3—34.0
Arithmetic mean and standard error	8.34 ±0.144	11.9 ±0.221	36.6 ±0.743	9.58 ±0.285	43.8 ±0.933	32.5 ±0.227
Standard deviation	0.594	0.911	3.064	1.178	3.848	0.938

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In the case where a mare is in an early stage of pregnancy and at the same time nursing a foal, it is doubtful that the developing fetus alone has much influence on the observed blood value. The authors, in work to be published, have demonstrated that the Thoroughbred mare in a late stage of pregnancy (nine to 11 months) but not lactating has the following average values: erythrocytes, 10,520,000/cmm.; hemoglobin, 14.89 gm./100ml.; and a packed volume of erythrocytes of 45.10%.

The data presented in this paper are indicative of the physiological strain lactation will place upon a mare. In cases where the mare is pregnant and nursing a foal, such a demand placed upon her by her nursing foal might well be detrimental to the developing fetus. Long nursing periods extending over eight months appear to be undesirable. Where a "suckled down" condition is evident in a pregnant mare nursing a foal, every consideration should be given to the possible effects such a condition might have upon the developing fetus.

It would appear that the nutritional level of lactating mares in central Kentucky is not at an optimum level as to protein intake and/or utilization. Studies on the nutritional level of the Thoroughbred horse are needed; such studies were indicated by Reed[1].

TABLE 2. DISTRIBUTION OF TYPES OF LEUKOCYTES OF 17 NON-LACTATING MARES AND 17 LACTATING MARES IN CENTRAL KENTUCKY.

Measure	Neutro.	Lymph.	Mono.	Eo.	Ba.
Non-lactating Mares					
Range	25.0—61.0	34.5—71.5	0.0—4.5	0.5—8.0	0.0—2
Mean and standard error	44.1 ±2.007	50.1 ±2.329	1.3 ±0.290	3.9 ±0.492	<0.5
Standard deviation	8.276	9.606	1.199	2.032	.....
Lactating Mares					
Range	23.0—54.0	35.5—72.0	0.0—4.0	2.5—11.0	0.0—0.5
Mean and standard error	37.6 ±1.840	50.6 ±1.264	1.5 ±0.270	5.0 ±2.034	<0.5
Standard deviation	7.588	5.247	1.117	8.388	.....

Summary

1. The following average blood values and their standard errors were recorded for 17 Thoroughbred non-lactating mares: erythrocytes, 9,690,000±0.278/cmm.; hemoglobin, 13.5±0.320 gm./100 ml.; packed volume of erythrocytes, 42.0±0.845, leukocytes, 10,800±0.489/cmm.; mean corpuscular volume, 43.7±0.944 cubic microns; mean corpuscular hemoglobin concentration, 32.1±0.302%.

2. Average blood values and their standard errors for 17 Thoroughbred lactating mares were as follows: erythrocytes, 8,340,000± 0.144/cmm.; hemoglobin, 11.9±0.221 gm./100 ml.; packed volume of erythrocytes, 36.6± 0.743%; leukocytes, 9,580 ± 0.285/cmm.; mean corpuscular volume, 43.8±0.933 cubic microns; mean corpuscular hemoglobin concentration 32.5±0.227%.

3. The non-lactating mares had significantly higher average blood values than did the lactating mares with the exception of the values for the mean corpuscular volume and mean corpuscular hemoglobin concentration.

4. Consideration should be given to the possible detrimental effects upon the developing fetus in long nursing periods extending over eight months or when a "suckled down" condition becomes evident in pregnant mares.

Acknowledgments

The authors wish to acknowledge the technical assistance of Mr. Madison Cawein in this study.

REFERENCE

1. Reed, O. E., What Do We Need to Know in Livestock Nutrition? Yearbook of Agriculture, Food and Life, pp. 1045-64, 1939.

Immunization Against Newcastle Disease With A Virus Of Low Virulence*†

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A NEWCASTLE disease virus (avian pneumoencephalitis) of very low virulence was introduced by Hitchner and Johnson[1] as an agent for immunizing chickens. As reported by them this virus, B1 strain, was of sufficiently low pathogenicity that it could be administered to day-old chicks hatched from susceptible hens. Older chickens were also immunized.

This study was undertaken to obtain further information on the nature and quality of immunity produced by the B1 vaccine virus and to determine its applications as an immunizing agent under practical conditions.

Methods

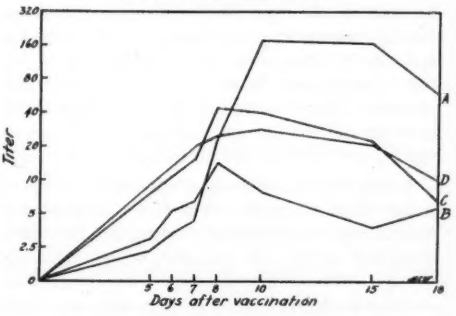
The virus employed in this study, strain B1, was obtained from Dr. S. B. Hitchner as amnioallantoic fluid (AAF) of the 74th embryo passage. For vaccination of chickens, undiluted AAF of the 75th, 76th and 77th embryo passages was used. The virus killed very few embryos on the second day after inoculation. Fluids for vaccine were obtained from embryos dying on the third and fourth days. The vaccine was stored in the fluid state in serum bottles at —26 C. All chickens were hatched from susceptible hens and maintained in isolation quarters to prevent infection which might complicate results obtained from the vaccine. The vaccination dose was 0.05 cc. of undiluted AAF virus.

The hemagglutination inhibition (HI) test was employed for studying the development of the antibody response. This test, the beta procedure, employed twofold serial dilutions of serum, five hemagglutination (HA) units of virus, and 0.5 cc. of 0.5% suspension of chicken red cells. The tests were read after 45 minutes at room temperature.

Route of Vaccination

Comparison of the HI response following intranasal and intramuscular vaccination with 0.05 cc. of B1 virus was made on chicks five days and five weeks of age. Blood samples were obtained at frequent intervals after vaccination. For the chicks five days of age, ten individuals were bled out for each testing period. For the five-week-old chickens, 20 were bled at alternate sampling periods. The average HI titers for the two groups are shown in figure 1. In the chickens five weeks of age, there was a very slight and transient increase

Figure 1.- HI Response to Intranasal and Intramuscular Vaccination



A.- Vaccinated intranasally, age 5 weeks.
B.- Vaccinated intramuscularly, age 5 weeks.
C.- Vaccinated intranasally, age 5 days.
D.- Vaccinated intramuscularly, age 5 days.

in the HI activity of the serum following intramuscular vaccination. The HI titers of individual chickens were less than serum dilution 1:40 except in two instances. The majority of chickens did not develop HI activity exceeding the 1:10 serum dilution. Serums obtained from the chickens vaccinated intranasally at five weeks of age had HI titers varying from 1:40 to 1:640 on the twelfth

*The investigation reported in this paper is in connection with a project of the Kentucky Agricultural Experiment Station and is published by permission of the director.

†This study was conducted as a segment of Research and Marketing Act Regional Project S6—Newcastle Disease of Poultry. The cooperating agencies under this project are the Kentucky, Virginia, and Texas Agricultural Experiment Stations. The research reported in this paper was done solely at the Kentucky Station.

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and fifteenth days following vaccination. Their HI response reached its highest level at the twelfth day and was receding at the fifteenth and eighteenth days. The HI response of chicks vaccinated at five days of age was similar for both routes. A slightly higher average titer was obtained with the intranasal vaccination. Individual chicken titers for corresponding bleeding periods were within the same limits for both routes of vaccination. The titers did not exceed the 1:160 serum dilution. The earlier appearance of HI titers of diagnostic level in the five-day-old chicks is not in agreement with other observations on development of the HI antibody. The difference observed here may be due to the age of the vaccine employed. Newly passed virus was used in the five-day-old chicks while that used for the five-week-old chicks had been stored for over two months. Chance selection of individuals in the five-day-old group may have been a factor in the higher titers at the sixth and seventh days.

TABLE 1. HI TITERS OF CHICKS VACCINATED AT VARIOUS AGES.

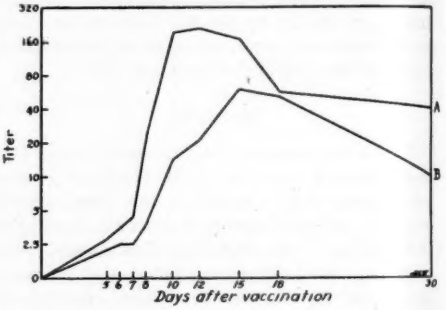
No. of chicks	Age vac. Days	Age when bled Days	Days since vac.	Range of titers (serum dil.)	Average titer
133	1	34	34	< 2.5 to 40	10.2
41	1	40	40	2.5 to 20	9.2
32	2	51	49	< 2.5 to 10	4.1
32	3	53	50	< 2.5 to 20	6.2
10	5	35	30	< 2.5 to 10	3.7
20	8	78	70	< 2.5 to 40	4.5
20	20	74	54	< 2.5 to 10	2.5
43	22	54	34	5 to 80	15.0
64	22	64	42	2.5 to 40	13.0

Using the HI antibody response as an index, it appeared that there was less stimulation of the antibody producing system by the intramuscular route of vaccination in both age groups. The difference was very marked in the chickens five weeks of age, and was slight in chickens vaccinated at five days of age. Chickens from the group vaccinated at five days of age were refractory to lethal infection when challenged 30 days later, and those vaccinated at five weeks of age were similarly immune when challenged 21 days after vaccination with 10^6 embryo $l.d._{50}$ of virus Ky-50. Symptoms of respiratory infection, were present in the five-week-old chickens vaccinated intramuscularly, but were absent in those vaccinated intranasally. Hitchner and Johnson[1] found that the chicks vaccinated intranasally withstood challenge exposure more satisfactorily than chicks vaccinated by the stick method. The B1 virus apparently immunizes more efficiently by the intranasal route than by either the intramuscular route or stick method.

Development and Persistence of HI Antibody

The HI titers of all vaccinated chickens were determined immediately before challenge exposure with virulent virus. It was found that the HI antibody engendered by the B1 vaccine persisted at diagnostic levels of 1:10 for relatively short periods. In many chickens the HI activity of the serum had fallen to dilutions of 1:2.5 or less to 1:10 within four to five weeks following intranasal vaccination. In a few chickens the HI antibody was present 70 days following vaccination at a titer of 1:40. For the chicks of different ages there was not a wide difference in the average HI titers at comparable periods following vaccination. Chicks three weeks of age at the time of vaccination had slightly higher average titers, and the range of the individual titers was at a higher level than for chicks vaccinated under one week of age. (Table I.)

Figure 2.- HI Response of Chicks Vaccinated at One Day and at Five Weeks of Age



A.- Five weeks of age. Average of 24 chicks.
B.- One day of age. Average of 18 chicks.

A comparison of the HI antibody response was made in chicks vaccinated intranasally at one day and five weeks of age. In the older chicks, a lot of 24 birds were bled from the wing veins for each testing period. For the day-old group, a lot of 18 chicks selected at random were bled out for each period until they were 15 days of age. Thereafter blood samples were obtained from the wing veins of a group of 18 chicks. The average HI titers were much higher in the older chicks. A significant increase in HI antibody appeared earlier in the older chicks and it was present at a higher level when the comparison was

terminated at 30 days following vaccination. (Figure 2.) As indicated by the HI titer response, the antibody producing system apparently develops in its capacity to produce antiviral substance with increasing age of the chick, as was observed by Wolfe and Dilks[2] for precipitating antibody. If the production of protective antibody parallels that of demonstrable HI antibody, immunization should be more satisfactorily accomplished in the older chicks.

Development of Protection in Vaccinated Chicks

Table 2 summarizes data of an experiment designed to determine protection of chicks vaccinated intranasally and immediately placed in an infective environment. Chicks two days of age were divided into three groups, 57 were used as controls, 59 were vaccinated intranasally with the B1 virus, and 60 were exposed intranasally with virus Ky-50. Approximately 20 minutes following vaccination and inoculation the chicks were placed together in equal numbers in compartments of electrically heated brooders. Deaths occurred in the B1 vaccinated group and controls at approximately the same time and continued throughout a comparable period. The mortality was 100% in the chicks exposed intranasally to virus Ky-50. It was 94.7% in the control chicks and 78% in the B1 vaccinated chicks exposed by contact to those receiving virus Ky-50 intranasally. There was obviously little protection against or interference with lethal infection in chicks vaccinated with the B1 virus and placed immediately in an infective environment.

TABLE 2. EFFECT OF VACCINATION WITH B1 VIRUS UPON CHICKS IN AN INFECTIVE ENVIRONMENT.

Group	No. of chicks	Death by days										Surv.
		3	4	5	6	7	8	9	10	11	12	
Controls	57	0	2	16	11	7	11	3	3	0	1	3
B1	59	1	1	7	9	7	11	5	4	1	0	13
Ky-50	60	1	9	42	6	1	1	-	-	-	-	0

Table 3 summarizes an experiment for determining the time at which protection develops following vaccination. Chicks were vaccinated intranasally with the B1 virus at ages of two, nine, 16 and 30 days. A control group of ten chicks for each age was exposed intranasally with virus Ky-50. An equal number of vaccinated chicks from each age group were similarly exposed at two, four, six, seven and eight days following vaccination. Protection resulting from vaccination was interpreted by the prevention of lethal infection and typical nervous symptoms during an observation period of 18 days.

In the chicks vaccinated at two days of age, there was no protection against challenge on the second day following vaccination. At four days, 80% of the chicks were protected. One chick died in each of the groups that were challenged on the sixth, seventh, and eighth days. Of the chicks vaccinated at nine days of age, there were four deaths and two that developed nervous symptoms in the group challenged two days after vaccination. In these, 33% were protected. One death occurred from the fourth day challenge and none for the later periods. For the chicks vaccinated at 16 days of age, there was approximately 50% protection against challenge at two days. None of the chicks challenged at four days died or showed nervous symptoms, but two developed nervous symptoms following challenge at six days. There were no deaths following challenge of chicks vaccinated at 30 days of age. Nervous symptoms developed in two chicks following challenge at two days and in one challenged at four days. The results obtained in this study are in general agreement with those of Hitchner and Johnson[1]. Protection was not evident at two days following vaccination of chicks two days of age. Protection was present at two days in the other age groups and was progressively more effective with increasing age of the chicks. All groups showed protective action of the vaccination at four days. Complete protection, however, was not present at six days for all age groups, but was present at seven days for all except those vaccinated at two days of age.

The Vaccination Reaction

The symptoms following vaccination with the B1 virus varied considerably in chicks of different ages and within given age groups.

TABLE 3. DEVELOPMENT OF PROTECTION FOLLOWING VACCINATION.

Vac. to challenge exposure Days	Deaths and nervous symptoms resulting from challenge. No. affected over no. challenged			
0	10/10	10/10	9/10	7/10
2	10/10	6/9	5/10	2/9
4	2/10	1/10	0/10	1/10
6	1/10	0/10	2/10	0/9
7	1/10	0/10	0/10	0/10
8	1/10	0/10	0/4	0/10
Age in days at vac.	2	9	16	30

Usually the first visible reaction to the vaccine in young chicks appeared on the fourth or fifth day following vaccination. In chicks vac-

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cinated at from one to five days of age, symptoms varied from slight sneezing to deep, labored breathing. Some chicks gasped on each inspiration. Hoarseness and rattling sounds were present in nearly all chicks. The mortality resulting from vaccination of chicks at one to three days of age has varied from one to 10% in different lots, with the over-all mortality during the first two weeks following vaccination averaging approximately 5%. In some groups, a variable number of chicks were severely ill for periods of ten to 14 days following vaccination. Such chicks grew slowly and at four to five weeks of age a comparable number of chickens could be classified as runts.

In chicks vaccinated at five to seven days of age, the vaccination reaction was less severe. Symptoms of respiratory infection were present in nearly all chicks but usually were limited to sneezing and rales. Very few chicks became severely ill. Their activity and feed consumption were slightly affected. Mortality associated with the vaccination reaction was usually under 3%. Vaccination of chicks at two to three weeks of age resulted in slight and transient symptoms of respiratory infection, usually disappearing by the twelfth day. Activity and feed consumption were almost unaffected. At four weeks of age and later, intranasal vaccination caused extremely mild respiratory infection. Many chickens of this age went through the reaction period without any visible symptoms. Feed consumption and activity appeared to be unaffected.

In flocks of laying hens, the vaccination reaction was accompanied by a drop in egg production varying from 20 to 50%. Normal production was resumed within two to four weeks following administration of the vaccine. Molting has not been observed in hens following use of the B1 virus. Feed consumption was not affected. Sneezing and rales were observed in some hens. One hatcheryman continued to set eggs obtained from hens during the vaccination reaction period. Hatchability of eggs obtained between the fourth and tenth days after vaccination was reduced approximately 40%. It was not determined if the lowered hatchability was due to infertility or an excessive number of embryo deaths. It was not possible to isolate virus from eggs laid by another flock on the fourth and fifth days following vaccination.

Although symptoms of respiratory infection may not be present in all vaccinated chickens, there appears to be little cause for concern regarding the presence or absence of "takes" following intranasal vaccination of susceptible chickens with the B1 virus. Approximately 700 chickens vaccinated at various ages have been examined by the HI test at various intervals following vaccination. Significant HI titers, indicating the occurrence of an immunizing reaction, have been found in every chicken, without exception.

Duration of Immunity

Chicks from susceptible hens vaccinated at ages varying from one day to five weeks usually have been refractory to lethal infection when challenged intranasally, intratracheally, or intramuscularly with virulent virus. The challenge doses have varied from 10^5 to 10^7 embryo l.d.$_{50}$. The strains used for challenge were Ky-50, a virus which usually killed 50% of chickens three weeks of age, and the Texas virus, strain GB, which has marked neurotropic properties and usually kills over 80% of chickens seven to eight weeks of age. One death resulted from challenge exposure with Ky-50 in a group of 90 chickens at 40 days following vaccination as day-old chicks. Twenty chickens from a group vaccinated at eight days of age were protected against lethal infection by virus Ky-50 at ten weeks of age. Another group of 20 chickens showed similar protection seven weeks following vaccination at the age of three weeks. Following vaccination at seven days of age, 30 chickens challenged at 12 weeks of age were refractory to lethal infection from intramuscular challenge with the GB virus. One chicken of this group developed torticollis but recovered. Other groups of chicks vaccinated at ages of five days to three weeks and challenged three to seven weeks later have been refractory to lethal infection by the GB virus.

It has not been possible to follow the serum neutralization (SN) response of chickens after vaccination with the B1 virus. One group of 20 chickens which were tested at ten weeks of age, following vaccination at eight days of age, had HI titers ranging from less than 1:2.5 to 1:40 with an average titer of 1:4.5. Pooled serum aliquots from the 20 chickens had an SN titer of $10^{3.5}$ embryo l.d.$_{50}$. Another group of 20 chickens vaccinated at three weeks of age had HI titers ranging from less than 1:2.5 to 1:10 with an average of 1:2.5 at ten weeks of age. Pooled serum from these had an SN titer of $10^{2.5}$ embryo l.d.$_{50}$. The low SN titers obtained in these chickens may represent a fall of circulating antibody similar to that of the HI antibody. As mentioned above, the interpretation of challenge experiments has

been made upon refractivity to lethal infection. The rapid loss of demonstrable HI antibody has also been discussed. By close observation of challenged chickens it has been observed that many of those which had lost demonstrable HI antibody will show symptoms of respiratory infection following intratracheal or intranasal challenge. These symptoms have been limited to sneezing and rales. The symptoms occurred within the usual incubation period for experimentally produced Newcastle disease. The chickens rarely showed any evidence of systemic illness. Their activity and feed consumption were not impaired. In following the HI activity resulting from the challenge exposure it was found that those which had very low HI titers underwent an anamnestic response. Their increase in HI antibody began two to four days earlier and reached higher titer levels than were obtained in susceptible controls. Chickens that had HI titers of 1:80 to 1:160 at the time of challenge did not show the anamnestic response in HI activity, and symptoms of respiratory infection were not observed.

It has not been determined if the respiratory symptoms and anamnestic response in HI activity subsequent to challenge exposure represent an active infection with Newcastle disease virus. In event that active infection does occur, experience with the B1 virus as early as one day of age conditions the chicken so that lethal infection is prevented. As indicated by results of challenge exposure, this protection has persisted for periods of nine to 11 weeks following vaccination at one week of age.

Yolk-Conferred Passive Immunity

The passive protection conferred to chicks through the yolk by immunized hens has been one of the major considerations in favor of the use of live virus vaccines. It appears that a lifelong immunity is expected from the use of living virus vaccines, and that chicks hatched from the hens are expected to have a passive protection of three to four weeks' duration. With Kentucky hatcherymen, the passive protection of chicks has been the principal objective in vaccination. Since the presence of passively conferred antibody has important bearing on control procedures for this disease, a study was made on the parental immunity resulting from vaccination with the B1 virus.

In estimating the protection derived from yolk-transferred antibody, 100 or more chicks were used for each age group. The chicks were divided into three groups, 20% being exposed by intranasal instillation of virus, 20% by intranasal instillation of virus, and 60% by contact with those inoculated intramuscularly and intranasally. For definitive expression of results, only the chicks that die and those showing typical nervous symptoms at 21 days following exposure are recorded. One group of 116 chicks was challenged for parental immunity at one day of age. These were hatched from hens vaccinated as young chicks, 18 to 28 days of age. The eggs were obtained approximately six months following vaccination. Deaths and nervous symptoms were 95.8 and 4.2%, respectively, in 23 chicks exposed intramuscularly. In 35 chicks exposed intranasally, deaths and nervous symptoms were 97.2 and 2.8% respectively. With 58 chicks exposed by contact, deaths were 92.1% and nervous symptoms 1.6%. The intranasal and intramuscular challenge was 10^5 embryo l.d.$_{50}$ of the Texas virus, strain GB.

In another trial, eggs were collected for hatching approximately four months following vaccination at ten weeks of age. The chicks were exposed at one week of age using 10^5 embryo l.d.$_{50}$ of the GB virus. Intranasal and intramuscular exposure was employed on 35 and 36 chicks, respectively, and 115 chicks were exposed by contact with the inoculated chicks. Deaths and nervous symptoms occurred in 91.6% of those exposed intramuscularly, in 76.1% of the intranasally exposed group, and in 73.9% of the group exposed by contact.

Summary

As indicated by the HI response, the immunizing action of the B1 vaccine was more efficient with intranasal instillation than by intramuscular injection. The occurrence of respiratory symptoms following challenge exposure of intramuscularly vaccinated chickens and their absence from intranasally vaccinated chickens likewise indicated that the intranasal route was more efficient.

The HI antibody was found to develop to higher titer and persist for longer periods as the age at time of vaccination increased, suggesting that the immunizing reaction was more efficient in the older chicks.

Protection by the interference phenomenon or cell blockade was found to be of little value in chicks vaccinated intranasally with the B1 virus and placed immediately in an infective environment.

Chicks vaccinated intranasally with the B1 virus at two days of age showed no protection against lethal infection when challenged two days later. Chicks vaccinated at nine to 30 days of age showed partial protection when chal-

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lenged two days later. Partial protection against lethal infection was present in chicks vaccinated at two to 30 days of age when challenged four days after vaccination. Dependable protection appears to have been developed in most chickens six days following vaccination.

Symptoms of respiratory infection may be seen in birds of all ages following vaccination with the B1 vaccine. The reaction becomes less severe with increasing age.

Mortality from vaccination may be as high as 10% in day-old chicks with a number of vaccinated chicks becoming severely ill and developing as runts. After one week of age the vaccination reaction is mild and the mortality from vaccination is negligible.

In laying hens, egg production may drop 20 to 50% for periods of two to four weeks as a result of the vaccination reaction.

Chicks vaccinated at early ages have resisted lethal infection at nine to 11 weeks following vaccination.

There was a rapid decline and disappearance of demonstrable HI antibody titer in chicks vaccinated with the B1 virus. Chickens that had lost demonstrable HI antibody were refractory to lethal infection but many of them developed mild symptoms of respiratory infection following challenge exposure.

Chicks hatched from eggs obtained four to six months after vaccination of hens as young chickens have very little or no passive immunity.

REFERENCES

1. Hitchner, S. B., and Johnson, E. P., A Virus of Low Virulence for Immunizing Fowls Against Newcastle Disease (Avian Pneumoencephalitis). *Vet. Med.*, 43:525 (Dec.), 1948.
2. Wolfe, H. R., and Dilks, E., Precipitin Production in Chickens. III. The Variation in the Antibody Response as Correlated with the Age of the Animal. *Jour. Immunol.* 58:245, 1948.

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Ten years ago a commercial poultry feed that would produce 3,300 eggs per ton stood at the top of the list in nutritive value; now the better feeds suffice for 4,000 eggs per ton.

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From 15 to 22 pounds of feed per day is required for the maintenance for 100 hens. The more feed hens can be induced to eat, in addition to the maintenance ration, the less the feed cost per dozen eggs.

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Chronic interstitial nephritis frequently follows leptospirosis.—*Gerry B. Schnelle, D.V.M.*

Postal Regulations Restrict Mailing of Vaccinated Chicks

Instructions, quoted below, of the Assistant Postmaster General, as published in the Postal Bulletin of April 4, 1950, have applied section 35.13 of the Postal Laws and Regulations to prohibit the mailing of baby chicks vaccinated with pneumoencephalitis (live virus) vaccine.

"Day-old chicks vaccinated with Newcastle disease are classed as non-mailable if a live virus vaccination has been used (applied intranasally) since this disease is considered infectious. It is understood that the chicks could be vaccinated after arriving at the destination instead of at the hatchery."

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Early clinical trials in the use of a new antibiotic, terramycin, produced by a newly discovered mold, *Streptomyces rimosus*, isolated from soil, indicates its effectiveness against whooping cough, pneumonia, syphilis, gonorrhea and other diseases.

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All-in-all, one may hazard the opinion that the parasites harbored by animals of the household are not as much danger to mankind as phobists wish to believe. No tragic epidemic has ever been traced to household animals.—*Jour. Am. Vet. Med. Assn.*

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Public Health Aspects Of Avian Pneumoencephalitis (Newcastle Disease)

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THERE is at present sufficient evidence available to justify the suspicion that the virus of pneumoencephalitis (Newcastle disease) may possess a degree of pathogenicity for man.

The disease is primarily one which affects domestic fowl; hence, the possible incidence and severity of the disease in man will be greatly influenced by the occurrence and character of the disease in the more susceptible avian hosts. Prior to a consideration, therefore, of the implications of this infection for man, it is considered worth while to review some of the more important features of the disease as it occurs naturally, particularly in domestic fowl.

In 1942, a virus was reported to be the cause of a respiratory nervous disorder of chickens for which the term pneumoencephalitis was later proposed[1,2]. Studies on the disease had been initiated following observations dating from 1935, on a nervous disorder of chickens frequently accompanied with respiratory symptoms. In 1944, it was demonstrated that the virus of pneumoencephalitis was immunologically related to that of Newcastle disease[3].

Despite the similarity or apparent identity of the causative agents, the clinical picture of the disease in this country was very much unlike that observed throughout the countries of Europe and Asia, where Newcastle disease was prevalent. It was observed by 1945 that the disease was well established in all the intensified poultry-producing sections of California. Affected flocks showed loss of appetite, high morbidity rate, respiratory symptoms and a marked drop in egg production. The mortality rate was rarely in excess of 10%, hence, differed from the disease as it occurred in other parts of the world where the mortality was reported to be frequently in excess of 50%. There was an exception to the usual outbreaks in California, where in 1944, the mortality in some flocks was reported as high as 30%.

In 1945, the disease was recognized in a number of states east of the Mississippi River, following which great concern was manifested by many livestock disease control officials and poultry industry representatives.

In view of the newly recognized cases, official agencies were prompted to consider the adoption of interstate regulations in an attempt to prevent a further spread of the disease. These contemplated moves emphasized the need for application of accurate diagnostic measures. Hence, through cooperative effort between a number of states and the BAI, centers were established at which workers throughout the country might obtain first-hand information and experience in the application of diagnostic methods. Within a few months following the adoption of these tests, it became apparent that the disease was widespread throughout the United States. These findings also indicated that the infection may have been introduced into at least a few of these states much earlier than had been suspected. There can be no doubt that we must now recognize pneumoencephalitis as one of the more common poultry diseases in the United States. This is an important factor in the consideration of public health aspects of the disease, inasmuch as opportunity is provided, because of the high incidence of infection, for most poultrymen, their families and neighbors to be exposed to the causative virus. Further, it has been demonstrated that the virus is present in the aerial environment of natural infection[4].

The character of the infection in poultry is such that an excellent opportunity for the release of the virus is provided because upper respiratory tissues are usually involved, the course of the disease is quite rapid, and the morbidity rate is usually 100% within ten days following introduction. All of these factors contribute to a high virus particle concentration in the litter and air. In many of the poultry-raising areas it is the practice to use what is known as the built-up litter method wherein shavings, straw, or other dry material is permitted to accumulate on the floor to a depth of several inches. The litter is not re-

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placed throughout the laying season and at times becomes dry, hence contributes to heavy dust clouds following agitation. Poultrymen working in these houses during and immediately following an outbreak of pneumoencephalitis are exposed to the virus by inhalation, through the conjunctiva, and possibly by other routes.

Also noteworthy is the fact that many cull birds suffering from the mild form of the disease may be sold and as a result provide exposure to those who handle birds through market channels.

An insight as to the apparent lack of significant virulence of this virus for human beings is provided by the small number of proved clinical cases in man despite apparent massive exposure. That these findings are not surprising is suggested by reports of considerable, if not complete, resistance on the part of some mammals to the virus.

Investigators working in widely separated geographical areas, and possibly with different strains of the virus, have reported horses, cattle, sheep, pigs, rabbits, guinea pigs and rats to be refractive following injection with the virus.

Infectivity trials have proved the Rhesus monkey (*Macaca mulatta*) and the Syrian hamster susceptible to the virus following intracerebral inoculation. In attempting to assess the public health significance of pneumoencephalitis, it has been found, therefore, that the opportunity for massive exposure to man is presented but that the infection in human beings has, thus far, been confined to a few cases, sporadic in nature, and with very mild clinical manifestations. The available literature contains six references to the disease in man and from only two of these has the virus been recovered.

Burnet (1943), reporting from Australia, described an accidental inoculation of Newcastle virus into the human eye following which a conjunctivitis was observed[9]. Similarly, Anderson, also from Australia (1946), reported on two laboratory infections characterized by conjunctivitis[10]. Shimkin (1946) reported on a case of conjunctivitis which he considered the result of Newcastle infection; however, the virus was not recovered. During the same year, a small epidemic of Newcastle disease occurred among employees at the Agricultural School at Makveh, Israel, with the concurrent outbreak in the poultry flock. Most of the employees affected were women working in a kitchen[11]. Howitt and co-workers reported on the presence of neutralizing antibodies of Newcastle disease virus in human serum in the United States, as did McGough, who reported on serum studies of persons who became ill following the ingestion of cooked chicken[12,13]. From none of the cases reported in the United States, however, until the recent report by Ingalls and Mahoney, has the virus of pneumoencephalitis been recovered[14]. The recoveries by Ingalls and Mahoney were made from a veterinary student also suffering a conjunctivitis[14]. The diagnosis was further confirmed by hemagglutination, hemagglutination inhibition, and virus-neutralization. These scattered human cases present sufficient evidence to indicate that the virus has potential pathogenicity for mammals. Any attempts, however, to ascribe symptoms in man to this disease should be substantiated by laboratory technics which include virus isolation and identification. The use of the hemagglutination-inhibition and virus-neutralization tests with human sera have to date been so limited as to preclude dependence upon the results of these tests alone.

REFERENCES

1. Stover, D. E., A Filtrable Virus; the Cause of a Respiratory-Nervous Disorder of Chickens. *Am. Jour. Vet. Res.*, 3:207 (Apr.), 1942.
2. Beach, J. R., Avian Pneumoencephalitis, Proc. 46th Ann. Meet., U. S. Livestock San. Assn., pp. 203-223, 1942.
3. Beach, J. R., The Neutralization *in vitro* of Avian Pneumoencephalitis Virus by Newcastle Disease Immune Serum. *Science*, 100:361, 1944.
4. DeLay, P. D., DeOme, K. B., Bankowski, R. A., Recovery of Pneumoencephalitis (Newcastle) Virus from the Air of Poultry Houses Containing Infected Birds. *Science*, 107:474 (May), 1948.
5. Beaudette, F. R., A Review of Literature on Newcastle Disease. Proc. 47th Ann. Meet., U. S. Livestock San. Assn., pp. 122-177, 1943.
6. Meyer, K. F., Mack W., and DeLay, P. D., Unpublished data, 1946.
7. Reagan, Reginald L., Lillie, Mary G., Poelma, Leo J., and Brueckner, A. L., The Response of Some Mammals to Newcastle Virus. *Am. Jour. Vet. Res.*, 8:427 (Oct.), 1947.
8. Wenner, Herbert A. and Lash, Beverly, *Proc. Soc. Exp. Biol. & Med.*, 72:263 (Feb.), 1949.
9. Burnet, F. M., Human Infection with the Virus of Newcastle of Fowls, *Med. Jour. Australia*, 2:313, 1943.
10. Anderson, S. G., A Note on Two Laboratory Infections with the Virus of Newcastle Disease of Fowls. *Med. Jour. Australia*, 1:371, 1946.
11. Shimkin, N. I., Conjunctival Hemorrhage Due to an Infection of Newcastle Virus of Fowls in Man. *Brit. Jour. Ophth.*, 30:260, 1946.
12. Howitt, B. F., Lindsay, K. B., and Kissling, R. E., Presence of Neutralizing Antibodies of Newcastle Disease Virus in Human Sera. *Am. Jour. Pub. Hlth.*, 38:1263, 1948.
13. McGough, T. F., Outbreak of Newcastle Virus Disease in Tuscarawas County, Ohio. *Ohio State Med. Jour.*, 45:25,1949.
14. Ingalls, W. L., and Mahoney, Ann., Isolation of the Virus of Newcastle Disease from Human Beings. *Am. Jour. Pub. Hlth.*, 39:740 (June), 1949.

Giardiosis Of The Chinchilla†

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DURING the past year, several chinchilla carcasses have been submitted to this laboratory for diagnosis[1]. In all animals examined, the protozoan *Giardia sp.* associated with a regional enteritis was noted. The enteritis, located in the upper section of the small intestine, varied from mild catarrhal to severe hemorrhagic types.

In 1936, Coale[2] reported that there was no known specific infectious disease from which these animals suffered. Since that time there has been a number of reports of both bacterial and parasitic diseases. Holm and Graves[3] in 1940, reported deaths in chinchillas due to paratyphoid infections. In 1942, Coburn, *et al.*,[4] isolated the paratyphoid organism from chinchillas and used bacterins in treating the infection. In the same animals in which we have found Giardia, we have isolated both paratyphoid and the staphylococcus organism. G. R. Schwar,[5] states that intestinal disorders (giardiosis, diarrhea, etc.) are probably responsible for the largest number of deaths due to sickness among chinchillas. The Brenon Research Laboratory in its 1947 Annual Report,[6] reported 61 out of 407 chinchillas examined to be infected with either one or both, Giardia and Trichomonas. The Brenon Research Division recommended a chemical, brenex by trade name, which has proved to be 100% effective.

In the 1948 Brenon Annual Report,[7] it is stated that giardiosis is very rare. The disease is considered pathogenic when at least 31 Giardia are counted per high-powered field. Diiodohydroxyquinoline is recommended as a medication, along with the elimination of roughage from the diet.

McIntyre[8] states that Giardia in chinchillas were first observed in the Los Angeles, Calif., laboratory in 1943, but they had observed an enteritis several years prior to this date. He reports that in initial outbreaks as many as 50% of the animals have a severe diarrhea and in some instances in chronic cases, anemia and cachexia have appeared. He recommends atabrine as a curative agent in conjunction

with other agents, such as penicillin or sulfamerazine, to combat secondary infection.

Schofield, *et al.*,[9] in 1947 gave an account of an outbreak in a group of 1,300 chinchillas in which 133 animals died. Giardia were present but he believed the predisposing cause of the outbreak was a nutritional deficiency rather than any specific organism. There were occasional deaths prior to the outbreak and a death rate of five per day after the outbreak. He reported curative treatment of limited value.

Katsampes, *et al.*,[10] state that giardiosis interferes with fat absorption in man.

Due to the value of chinchillas, it has been impossible to determine experimentally if the death of the chinchillas submitted was actually due in part or totally to the presence of Giardia in the intestinal tract. As previously mentioned, in some instances Salmonella and Staphylococcus organisms have been isolated. However, even here it is possible that the Giardia was a contributing factor to death.

Sections of the duodenum of the chinchillas submitted were scraped in order to obtain material for preserved mounts and for measurements. Slides were stained with either Wright's or Giemsa's stain. It was found that

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Progress Report, B.J.O. 85, Internal Parasites of Domestic and Wild Animals and Birds of North Dakota.

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these protozoan organisms encysted in a 24-hour period when the duodenal material was placed in a 2% potassium dichromate solution and aerated. Since the measurements varied so little, an average of ten measurements was considered sufficient. The measurements were taken of unstained specimens. The averages are listed in table I.

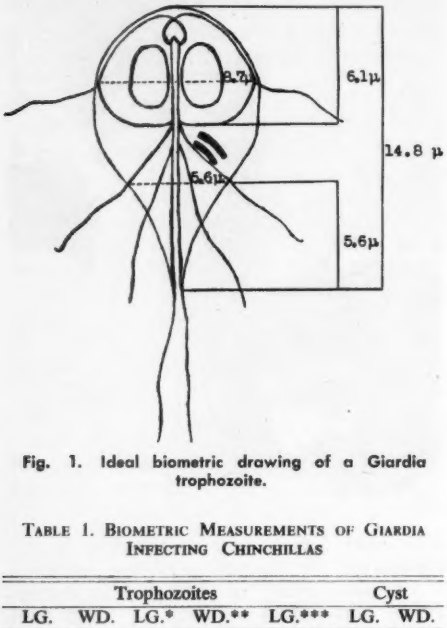

Fig. 1. Ideal biometric drawing of a Giardia trophozoite.

TABLE 1. BIOMETRIC MEASUREMENTS OF GIARDIA INFECTING CHINCHILLAS

Trophozoites					Cyst	
LG.	WD.	LG.*	WD.**	LG.***	LG.	WD.
14.8†	8.7	5.6	5.6	6.1	11.9	8.0

NOTE:
LG.—Length, WD.—Width.

*Length from posterior end to posteriorly attached flagella.
**Width where posteriorly attached flagella leaves body.
***Length of sucking disc.
†All measurements in microns.

Morgan[11] measured Giardia trophozoites from a chinchilla and found them to vary from 11 to 20 microns in length and from six to ten microns in width. He reported the cysts measured from nine to 11 microns in diameter. The average measurements in table I for the trophozoites come within the measurements reported by Morgan.

The average measurement of the cysts was 0.9 micron wider than the greatest measurement reported by Morgan.

Simon and Hegner, as cited by Wenyon,[12] have introduced a biometric method for the separation of species of Giardia. This involves the measurement of a sufficient number of protozoa and the construction of curves showing the percentage of Giardia of any one size.

Figure 1 gives a biometric drawing of the Giardia infecting the chinchillas. Figure 2 is the same type of drawing of the cyst.

Summary

The flagellate found associated with enteritis of chinchillas has been discussed and measurements of the same given.

REFERENCES

1. North Dakota Agricultural Progress Through Research, Annual Report of the North Dakota Agricultural Experiment Station Bulletin 356, January 1950.

2. Coale, B. B., Chinchillas: Past, Present, Future. *Vet. Med.*, 31:516 (Dec.), 1936.

3. Holm, G. C., and Graves, P., Paratyphoid in Chinchilla. *Vet. Med.*, 35:501 (Sept.), 1940.

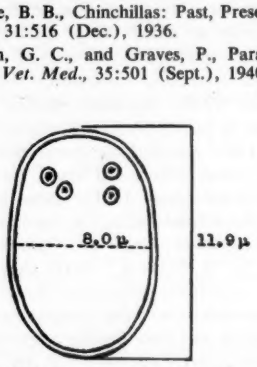

Fig. 2. Ideal biometric drawing of a Giardia cyst.

4. Coburn, D. R., Armstrong, W. H., and Wetmore, P. W., Observations on Bacterin Treatment of Salmonella Typhimurium Infection in Chinchillas. *Am. Jour. Vet. Res.*, 3:96, 1942.

5. Schwar, G. R., Raising Chinchillas for Profit. Fur Trade Journal of Canada.

6. Annual Report of Brenon Medical and Biological Research Laboratory, Chinchilla Division, 1947. Murray and Gee, Inc., publisher, Culver City, Calif.

7. *Ibid*—1948.

8. McIntyre, R. W., The Chinchilla and Its Diseases, Los Angeles County Livestock Department.

9. Schofield, F. W., and Scollard, N. D., An Extensive Outbreak of Acute Gastroenteritis Among Chinchilla. *N. Am. Vet.*, 27:756, 1947.

10. Katsampes, C. P., Phillips, W. A., McCoord, A. B., and Harris, S. T., Indicanuria and the Vitamin A Absorption Test in Giardiosis. Abst., *Jour. Parasit.*, 27:6 (Dec. Supplement), 1941.

11. Morgan, B. B., Giardia Infection in a Chinchilla. *Jour. Parasit.*, 35:6, 1949.

12. Wenyon, C. M., Protozoology, Vol. I, William Wood & Co., publisher, 1936.

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Last year, 31,800 Americans were killed in traffic accidents.

The Clinical Use Of Tyrothricin- B. F. I. Uterine Tablets In Cows*

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UTERINE infections subsequent to parturition frequently occur in cows. In many instances, fetal membranes are retained for variable periods of time, leading the owner to request manual removal of them. The desirability of such treatment is, in many respects, controversial.

Clark[1] reported on the use of tyrothricin in the treatment of uterine infections in cows; he found this antibiotic agent to be of value in such cases. Cushing,[2] as well as other practicing veterinarians, found B.F.I. powder in mineral oil or in capsules to be beneficial in controlling uterine infection prior to or after the manual removal of the placenta.

This is a clinical report of our studies with compressed tablets of the following composition:

Tyrothricin	0.05 gm.
Bismuth-formic-iodide	0.5 gm.
Bismuth subgallate	2.0 gm.
Boric acid	2.15 gm.
Urea	1 gm.

The tyrothricin—B.F.I. uterine tablets were used on cases of metritis, retained placenta, and metritis following retained placenta. A total of 210 animals have been treated with this preparation.

In this study, the usual procedure was to insert two to four tablets at each treatment depending upon the degree of infection. It was found that, if the tablets were not broken in pieces manually, they had a tendency to be eliminated in one piece instead of disintegrating in the uterine fluid.

The types of cases in which these tablets were used may be divided into four groups:

(1) In the first group were cases of retained placenta. The membranes could be removed completely 24 hours after the animal calved. In this group there were 110 animals in which tyrothricin—B.F.I. uterine tablets were inserted after the manual removal of the placenta. These animals showed no evidence of metritis and no excessive uterine discharge. The cows were bred promptly at three months after freshening. The cause of retention of the placenta was considered to be atony of the uterine wall because of the presence of a large calf, twins, or some unidentified infectious agent.

(2) In the second group were those cases in which there was partial manual removal of the placenta, but in which some placental tissue remained intact with the result that the cervix did not close completely. These cases usually were treated twice by inserting crushed tablets at the first call (24 hours after parturition) and again at a subsequent visit in one or two days. These responded well, the placenta dropping away on the ninth or tenth day. None of 20 animals treated in this manner exhibited any signs of septicemia.

(3) The third group of animals with retained placentas were made up of those that aborted during the sixth to eighth month of pregnancy. It is assumed that these abortions were caused mainly by infection, probably with *Brucella abortus* in most cases. There were 50 such cases. No attempt was made to remove the membranes. Tyrothricin—B.F.I. uterine tablets were deposited in the uterus 24 hours after the abortion. The owner was informed that the placenta would be discharged in due time. It was noted in those cases in which these uterine tablets were used that there was little or on offensive odor from the uterine discharge and no evidence of septicemia; this was in contrast to those cases that received no treatment. In these latter cases, often we were called to treat them for metritis or even septicemia four or five days after the abortion.

(4) The fourth group of cows treated were those that developed metritis about a week or ten days after calving. According to the owners, these cows discharged the placenta normally. It was usually found on examination, however, that a small portion of the placenta was retained and the cervix closed so that the debris and fluids were not discharged. In some cases the cervix remained

(*Continued on page* 245)

*The Tyrothricin—B.F.I. uterine tablets used in this study were prepared by Sharp & Dohme, Inc., Philadelphia, Pa.

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An Aid To Cataract Surgery

RAYMOND J. GARBUTT, D.V.M., New York City

THE removal of cataracts has always been a problem, particularly in older patients, whose eyes do not usually bulge. In Cocker Spaniels and similar types, with normally prominent eyes, the problem is not so difficult. However, with many old terriers it is extremely difficult to operate for removal of a cataract, because the eye is depressed and even with the insertion of corneoscleral and conjunctival sutures to elevate the eye, it is trying to position the structure for surgery.

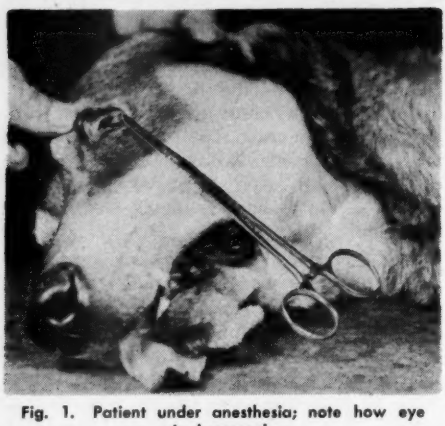

Fig. 1. Patient under anesthesia; note how eye is depressed.

The time required for perforating the cornea and removing the lens is very important, as speed is essential.

When the cornea is perforated, the aqueous humor is rapidly discharged. From this point on, the operator must work with speed and precision to remove the lens and suture the cornea, as the eye rapidly recedes into the orbital cavity.

It has been found that by the injection of fluid into the retrobulbar fat of the eye socket, the globe may be brought outward; thus creating a temporary prominent bulging.

Technic

The pupil is dilated with atropine and the patient anesthetized with nembutal. Hair around eyes and face is clipped and shaved, then painted with a skin disinfectant. A few drops of a local anesthetic are dropped into the eye, which is then flushed with a 1:5,000 solution of metaphen. A 5 or a 10 cc. syringe,

Fig. 2. Temporary protrusion of eye due to injection of solution into the retrobulbar area.

to which is fitted a one inch no. 24 gauge needle, is then filled with a solution of sterile aqueous solution containing 100,000 units of penicillin. An Allis forceps is clamped to the conjunctiva to steady the eye and the needle inserted down to the retrobulbar area and a small quantity of solution injected into the area. Injections are made around the eye, but the area near the inner canthus is avoided. It is necessary to avoid injecting the solution

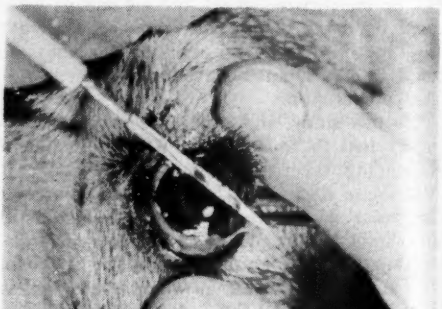

Fig. 3. Note ease of penetrating cornea after the injection of solution.

into the conjunctival tissue, as in this case the tissue will balloon but the eyeball will not be forced outward.

Under this pressure from the depth of the retrobulbar area, the eye is operated on in the usual manner for cataract removal. To date, six cases have proved the practical success of the procedure outlined.

The *In Vivo* And *In Vitro* Effect Of Aureomycin Upon *Pasteurella Multocida**

J. E. PRIER, D.V.M., M.S., Urbana, Illinois**

AUREOMYCIN, an antibiotic derived from *Streptomyces aureofaciens*, was first described by Duggar[1] in 1948. Preliminary studies on human patients have shown that the drug is effective in treating infections caused by certain Rickettsia and bacteria.

Little is reported in the literature on the effect of aureomycin in animal infections. McCulloch, Kiser and Migaki[2] used it in staphylococcic mastitis of cattle. Little[3] showed that aureomycin was effective in treating laboratory animals experimentally infected with *Pasteurella multocida* and *Erysipelothrix rhusiopathiae*.

The present paper describes a study of the *in vitro* and *in vivo* effect of aureomycin on *Pasteurella multocida*.

Materials and Methods

A. *In Vitro Tests*: The effect of aureomycin *in vitro* on four strains of *P. multocida* was observed. Similar tests were run with penicillin G and streptomycin for comparison. Serial dilutions of the antibiotic in brain-heart infusion broth were made. A series of 13 tubes was set up. The first tube contained 2.4 ml. of broth; the remaining tubes each contained 2 ml. of broth. One and six tenths ml. of an antibiotic solution were added to the first tube of the series to make a concentration of 400 gamma/ml. The contents of the tube were thoroughly mixed with a sterile pipette, and 2 ml. removed and placed in the second tube. The procedure was repeated through 12 tubes, 2 ml. of the twelfth tube being removed and discarded. The last tube was retained as control without antibiotic. The concentrations of antibiotic in the series were 400, 200, 100, 50, 25, 12.5, 6.25, 3.12, 1.60, 0.80, 0.40, 0.20 and 0 gamma/ml.

Each tube was then inoculated with a loopful of a 24-hour culture of the strain of Pasteurella to be examined. All tubes were examined after 12 and 24 hours of incubation at 37.5 C. The end point of inhibition by the antibiotic was taken as the last tube in which no turbidity could be seen.

B. *Chick Embryo Tests*: Seven and 12-day chick embryos were infected with a 24-hour brain-heart infusion broth culture of *P. multocida* by inoculation into the allantoic cavity. Immediately after infection 250 to 2,500 gamma of aureomycin in 0.1 ml. of fluid was inoculated into the allantoic cavity. Inoculated eggs were candled daily, and the embryonic fluids of all dead embryos were cultured on blood agar. All live embryos were discarded six days after inoculation.

C. *Inoculation of Experimental Chickens*: Chickens from two to 13 weeks of age were used in this experiment. Three strains of

TABLE 1. *In vitro* ACTIVITY OF AUREOMYCIN, STREPTOMYCIN AND PENICILLIN AGAINST *Pasteurella multocida*.

Strain of *P. multocida*	Antibiotic	Highest Dilution of Drug Showing Inhibition (gamma/ml.) 12 Hr. Incub.	24-Hr. Incub.
6-1	A.	0.40	1.60
6-1	A.	0.20	1.60
6-1	P.	0.80	3.12
6-1	P.	0.80	3.12
6-1	S.	12.5	12.5
6-1	S.	3.12	25.0
6-2	A.	0.40	3.12
6-2	A.	0.80	3.12
6-2	P.	3.12	12.5
6-2	P.	1.60	1.60
6-2	S.	1.60	6.25
6-2	S.	0.80	6.25
6-4	A.	0.40	0.80
6-4	A.	0.20	0.80
6-4	P.	3.12	12.5
6-4	P.	1.60	3.12
6-4	S.	3.12	12.5
6-4	S.	3.12	6.25
6-5	A.	0.20	1.60
6-5	A.	0.40	3.12
6-5	P.	1.60	1.60
6-5	P.	1.60	6.25
6-5	S.	6.25	12.5
6-5	S.	6.25	6.25

A-aureomycin P-penicillin S-streptomycin

*Aureomycin supplied by Lederle Laboratories Division, American Cyanamid Company, Pearl River, N. Y.

**College of Veterinary Medicine and Agricultural Experiment Station, University of Illinois.

The technical assistance of Mr. Gerald Dart is acknowledged.

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P. multocida were used. The number of organisms injected varied according to the age of the birds. In chicks four weeks of age, or younger, inoculation was made intraperitoneally; in birds over four weeks of age, inoculation was made intramuscularly.

Table 2. Aureomycin Treatment of Chick Embryos Infected with *P. multocida* (Strain 6-7).

Age of Embryos	Pasteurella Infecting Dose	Gamma of Aureomycin	Mortality Fraction*	Recovery of Organism from C-A Fluids of Dead Embryos**
12	90,000,000	2500	3/7	+
12	90,000,000	500	4/7	+
12	90,000,000	250	4/7	+
12	90,000,000	None	5/5	+
12	.....	2500	0/5	
11	9,000,000	2500	2/8	+
11	9,000,000	1250	1/8	+
11	9,000,000	250	2/8	+
11	9,000,000	None	8/8	+
11	.....	None	0/4	
12	90,000,000	2500	4/9	+
12	90,000,000	1250	1/9	+
12	90,000,000	500	6/9	+
12	90,000,000	250	6/9	+
12	.....	2500	2/9	—
12	90,000,000	None	9/9	+

*Number of embryos dead/number of embryos inoculated.
**One loopful of chorioallantoic fluids cultured on a blood agar plate.

Birds were treated either by intraperitoneal or intramuscular inoculation of an aqueous solution of aureomycin or with dry aureomycin mixed in the feed. Injected doses varied from approximately 1.5 to 50 mg./lb. of body weight. The aureomycin concentration in the feed varied from 100 to 700 mg./kg.

Birds that died following infection were autopsied; their livers were cultured on blood agar to ascertain if Pasteurella was present. The organism was recovered in all cases. The period of observation of infected birds was from seven to 14 days.

Results

A. *In Vitro Tests*: The results are shown in table 1. Aureomycin inhibited the organism in lower concentrations than either streptomycin or penicillin. Both aureomycin and penicillin were more inhibitory than streptomycin. The *P. multocida* strains were inhibited by 0.80 to 3.12 gamma/ml. of aureomycin, 1.60 to 12.5 gamma/ml. of penicillin G, and 3.12 to 25 gamma/ml. of streptomycin.

B. *Chick Embryo Tests*: The results are shown in table 2. Some of the embryos infected

Table 3. Treatment of Chicks Infected with *P. multocida* by Parenteral Administration of Aureomycin.

Number of Chicks	Age	Infecting Dose (No. of Org.)	Strain	Treatment	% Survival
16	7 weeks	75,000,000*	6-7	50 mg. at time of infection and 50 mg. 24 hr. after infection*	87.5
16	7 weeks	75,000,000*	6-7	None	6.2
5	7 weeks	None		None	100.
5	7 weeks	None		50 mg./day for two days*	100.
10	5 weeks	45,000,000*	6-7	25 mg.-time of infection*	60.0
11	5 weeks	45,000,000*	6-7	None	9.0
5	5 weeks	None		None	100.
5	5 weeks	None		25 mg.—one dose*	100.
20	3 weeks	18,000,000**	6-7	1 mg.—time of infection and 1 mg., 24 hours later**	95.0
20	3 weeks	18,000,000**	6-7	0.75 mg. —time of infection and 0.75 mg., 24 hours later**	60.0
20	3 weeks	18,000,000**	6-7	0.5 mg.—time of infection and 0.5 mg., 24 hours later**	60.0
20	3 weeks	18,000,000**	6-7	0.25 mg.—time of infection and 0.25 mg., 24 hours later**	60.0
10	3 weeks	18,000,000**	6-7	None	50.0
10	3 weeks	None		None	100.
10	3 weeks	None		1 mg./day for two days**	80.0***
38	12 weeks	150,000,000*	6-4	50 mg.—time of infection*	100.
38	12 weeks	150,000,000*	6-4	None	39.5
6	12 weeks	None		50 mg.—one dose*	100.
23	4 weeks	90,000,000**	6-5	10 mg.—time of infection**	74.0
21	4 weeks	90,000,000**	6-5	None	4.8
5	4 weeks	None		None	100.
5	4 weeks	None		10 mg.**	100.

*Intramuscular inoculation **Intraperitoneal inoculation ***Deaths, accidental

with 90,000,000 and 9,000,000 organisms were protected by treatment with aureomycin immediately after infection. All untreated infected embryos died. Pasteurella was recovered from the allanto-amniotic fluids of all of them by inoculation onto blood agar plates. Doses of 250 to 2,500 gamma were of value in treating the embryos, but there was apparently no direct relationship between the amount of aureomycin administered and the number of embryos protected.

C. *Treatment of Infected Chicks*: The results are summarized in tables 3 and 4. Aureomycin reduced the mortality of infected groups when given parenterally at the time of exposure. Birds treated with 25 to 50 mg. of aureomycin by intramuscular and intraperitoneal inoculation showed an increase in survival of 50 to 80% over untreated controls. No critical experiments were conducted to determine optimum dosage. Less than 1 mg. of aureomycin is apparently not satisfactory in young chicks infected with more than 18,000,000 organisms.

TABLE 4. TREATMENT OF CHICKS INFECTED WITH *Pasteurella multocida* WITH AUREOMYCIN IN THE FEED.

No. Chicks	Age	Infecting Dose*	Strain	Conc. Drug in Feed mg./kg.	% Surv.
10	2 wk.	75,000,000	6-7	250	30
10	2 wk.	75,000,000	6-7	500	10
10	2 wk.	75,000,000	6-7	None	0
10	2 wk.	None	6-7	500	90
10	4 wk.	90,000,000	6-5	352	0
21	4 wk.	90,000,000	6-5	None	0
5	4 wk.	None	-	None	100

*Intraperitoneal inoculation

On a body weight basis, dosages of 50 mg. might seem excessive. However, no evidence of toxicity was noted in birds receiving the drug alone. At autopsy no gross lesions were observed that could be attributed to toxic action of the drug.

Aureomycin was given orally in concentrations of 250 to 500 mg./kg. of feed. Infecting doses of Pasteurella were 75,000,000 and 90,000,000 organisms administered intraperitoneally. The survival rate in treated birds was only 15 to 30% higher than in untreated controls. Apparently either insufficient feed was consumed or the antibiotic was not absorbed rapidly enough from the intestinal tract. No data are available at present on the normal aureomycin blood levels of chickens fed the drug.

Summary

1. Aureomycin inhibits *P. multocida in vitro* in concentrations less than either penicillin or streptomycin.

2. Chick embryos infected with *P. multocida* were protected in part by treatment with 250 to 2,500 gamma of aureomycin.

3. The survival rate of chicks experimentally infected with *P. multocida* and treated parenterally with 1.5 to 50 mg. of aureomycin per lb. body weight was 50 to 80% higher than that of untreated controls.

4. Mixing 250 to 500 mg. aureomycin/kg. in the feed increased the survival rate from 15 to 30% over untreated controls.

REFERENCES

1. Duggar, B. M., Aureomycin, A Product of the Continuing Search for New Antibiotics. *Annals N. Y. Acad. of Sci.*, 51:177, 1948.

2. McCulloch, E. C. Kiser, J. S., and Migaki, H. Aureomycin in the Treatment of Staphylococcic Mastitis in Cows. *Vet. Med.*, 44:253, 1949.

3. Little, P. A., Use of Aureomycin in some Experimental Infections in Animals. *Annals N. Y. Acad. of Sci.*, 51:246, 1948.

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The Clinical Use of Tyrothricin—B.F.I. Uterine Tablets in Cows

(*Continued from page* 241)

open and a profuse fetid discharge was the characteristic sign of infection. Thirty animals were treated with a uterine douche containing crushed tablets. In those cases where the animals were extremely toxic, a dose of 2 oz. of sodium sulfamerazine was administered intravenously as an adjunct to the local uterine treatment. In many of these cases it was found necessary to repeat this treatment at 48 hours in order to alleviate toxic symptoms and to control the infection. Prompt healing of the uterus in a large number of the cows was indicated by the fact that they were bred successfully three months after parturition.

Summary

Tyrothricin—B.F.I. uterine tablets were used in 210 cows to prevent metritis and septicemia and to promote healing of the uterine wall. The results indicate that it is a safe and effective preparation for use in such cases.

REFERENCES

1. Clark, C. F., *M. S. C. Veterinarian*, 3:133, 1943.

2. Cushing, E. R., *Jour. Am. Vet. Med. Assn.*, 96:615 (May), 1940.

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Sulfanilamide was first synthesized about 1860 and remained buried in the literature of organic chemistry until 1935.

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PRINCIPLES OF ANIMAL HEALTH

R. R. DYKSTRA, D.V.M.
Manhattan, Kansas

Salmonellosis is a serious problem for the physician, and by no means a minor one for the veterinarian, as the latter has discovered in the handling of pullorum disease in chicks; infectious necrotic enteritis, or as a complication of hog cholera; enteritis in turkey poults, and others. There are many strains of the Salmonella organism—200 or more have been described. Children and young animals are most susceptible. The food poisoning in man, a salmonellosis, may be contracted following the consumption of insufficiently cooked pork and fowl, eggs from stored foods contaminated by rodents and dogs, by the contact of infected farm animals, and other ways. Veterinarians at least should carry this information to their clients by warning them of the danger in handling infected animals unless sanitary precautions are taken.

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Some laboratories are reporting a relatively large number of agglutination reactions indicating the presence of the *Vibrio fetus* in brucellosis-clean herds in which there are abortions. Some of the more conservative technicians are hesitant about an unqualified diagnosis of *Vibrio fetus* infection based solely on the serological test. These persons still insist that the microscopic or cultural identification of the organism is essential for a positive diagnosis.

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The 1949 Bureau of Animal Industry Report states that on a comparative basis there was a closer correlation between tuberculin reactions by the Stormont method and by lesions found on autopsy than by any other test. The cervical test and the subcutaneous test caused reactions in a higher percentage of cases showing no lesions on autopsy.

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Late reports seem to indicate an increased number of western lambs infested with the fringed tapeworm *Thysanosoma actinoides,* though no light has as yet been thrown on mode of transmission of this parasite. The parasite makes the liver unfit for human food, occasioning an estimated loss of $500,000. annually.

There is accumulating evidence that so-called Q fever in man, first discovered in southern California in 1947, may be ascribed to the consumption of raw milk and other raw dairy products. Pasteurization methods ordinarily employed will not destroy the causative organism. The disease is due to a Rickettsia, *Coxiella burnetii.* It also may be transmitted by handling live or recently slaughtered dairy cows and their calves. Q fever is most likely to occur not only in those consuming raw dairy products but also those employed in abattoirs, dairies, rendering plants, creameries, and hide plants.

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The Michigan Agricultural Experiment Station reports in regard to the rather widely publicized animal protein factor (APF) that, "Incubated horse manure was found to be a potent source of APF while fresh horse manure contained no activity." Evidently intestinal synthesis of this factor does not occur in horses. The report also indicates that the addition of certain crystalline vitamins to the diet of chicks had the "same growth stimulating effects as APF" though "the growth effects produced by the vitamins and APF were different and additive."

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The jugular vein is the preferred site for the collection of blood samples from horses, cattle, sheep and goats, and thin-necked dogs. For dogs and cats, many operators prefer any of the larger veins of either a fore or a hind limb. Swine may be bled from an ear vein, and by a partial caudectomy; the anterior vena cava is another good site for bleeding swine. Poultry are bled from the under side of the wing at the point where the vein crosses the articulation.

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A correspondent recently asked us how much cobalt, iron and copper should be allowed suckling pigs. We informed him that there is no evidence that pigs suffer from cobalt deficiency, this having been observed only in cattle and sheep. Iron and copper may be given by painting the sows' mammae with a copperas solution, as is well known to all veterinarians.

EDITORIAL COMMENTS

Restrictions of Movement of Tuberculosis-Exposed Cattle

In an endeavor to stop the spread of tuberculosis infection in cattle in California, the 1949 legislature of that state added provisions to the Agricultural Code which are intended to regulate the movement of animals from infected into clean herds.

As a working arrangement to implement the provisions of the new law, Dr. A. K. Carr, Administrator, Division of Animal Industry, California Department of Agriculture, has issued the following instructions to veterinarians conducting official tuberculin tests:

1. Written notice to an owner classifying his cattle as tuberculosis-exposed will be issued in cases where 5% or more of the total number of animals in the herd tested are classified as reactors.

2. After reactors are removed and slaughtered under veterinary inspection, should 5% of the total number of animals tested show positive lesions of tuberculosis, the notice referred to will continue in force until the remaining cattle have passed two clean tests at approximately 60 day intervals. On completion of the second negative test, the notice of tuberculosis-exposed cattle will be released.

Should less than 5% of the total number of cattle tested not show positive lesions of tuberculosis on postmortem examination, then the notice referred to will be released and the owner notified of such action.

3. When a herd is classified as tuberculosis-exposed and notice has been issued the owner to this effect, then cattle from a herd so classified can be moved only under permit and then for one of the following reasons:

(a) To an establishment operating under state, state-approved, or federal meat inspection, or a public stockyards designated by the department to handle reactors and tuberculosis-exposed cattle for slaughter; (b) To another premise where tuberculosis-exposed cattle are kept; or (c), To another premise where no spread of tuberculosis to other cattle could occur.

These new provisions of the law have been designed in an effort to aid the tuberculosis eradication program. They provide a means of stopping the movement of animals from badly infected herds that are potentially dangerous as a source of spread of the disease.

New A.V.M.A. Directory

The A.V.M.A. has announced publication of its new 1950 Directory, containing the most complete listing of veterinarians ever assembled.

Names, addresses, and other pertinent information on 14,000 veterinarians in the United States and Canada, and of 350 in other countries, are listed in the 1950 edition.

Also included is detailed information about colleges of veterinary medicine, not only in the United States and Canada, but throughout the world. Among other principal features of the 288-page directory are listings of secretaries of veterinary medical and related associations, chief livestock sanitary officials, organization and key personnel of all United States and Canadian government veterinary services, digests of practice acts, veterinary science departments in land-grant colleges, code of ethics, and complete data on the organization of the national association.

Copies of the 1950 edition may be obtained from the A.V.M.A. office, 600 S. Michigan Ave., Chicago 5, Ill. Price to members is $2.; to non-members, $10.

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Trichina Infection Declines

Federal meat inspection regulations recognize two categories of pork products; (1) fresh pork cuts, which are normally cooked thoroughly before serving, and (2) sausage items including frankfurters, boiled ham, salami, bologna, etc., that are sold as ready-to-serve without further cooking.

In the group of ready-to-serve meats, federal processing requirements include heating to at least 137 F., freezing, and a variety of specified curing processes depending on the product. A series of examinations to check the efficiency of regulations designed to destroy any trichinae that might be present indicated that 26 samples of 3,171, or 0.81%, contained the encapsulated larvae. Further tests have satisfied investigators that infective powers of these few larvae had been completely destroyed by packing house treatment.

This incidence of infection indicates a general reduction in trichina infection when compared to similar studies during the period 1934 to 1939, at which time 3.32% of samples submitted for examination contained some of the organisms.

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The A.V.M.A. Florida Convention

The stage is set at the new air-conditioned municipal auditorium in Miami Beach, Fla., to receive visitors to the 87th annual convention of the A. V. M. A., August 21-24, 1950.

Though not as yet announced, the scientific program promises interesting discussions on current issues by national authorities.

Unusual recreational attractions planned for visitors by Dr. E. C. Clawsen of Miami, heading the committee on local arrangements, and his co-workers, is in measure responsible for the enthusiastic response to the invitation to visit Miami Beach this year. Special pre-convention tours have been arranged, as well as local sight-seeing trips, prior to and during the four day meeting. An official post-convention air or boat trip to Cuba is also scheduled through the cooperation of the Cuban veterinarians. A scientific program will be integrated with planned entertainment in Havana.

Most people, even those to whom the veterinarian is a familiar figure on the farm or at the clinic where they may take the family pet if it falls ill, have an idea that veterinary medicine is concerned entirely with the treatment and prevention of disease in animals. This impression is incorrect. There are more than 75 diseases of animals transmissible to man, and the veterinarian is fully conscious of this potential danger to human health. He therefore, shares with the public health specialist a growing interest in these diseases which are common to man and his flocks.

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In a comparison of the *Brucella abortus* ring test and blood agglutination test on 8,469 herds in Minnesota, of which 385 (4.5%) were classified as infected on the basis of the blood test, there was an agreement between the two tests on 96.2% of the herds. Roepke, Martin H., *et al., Am. Jour. Vet. Res.,* 11:199 (Apr.), 1950.

Famed Hialeah Park race track, patronized by thousands of racing fans during the winter season, is a showplace of great beauty and is kept open the year around so that visitors may view it.

Winners in Student Contest Announced

VETERINARY MEDICINE is pleased to announce the winners among senior veterinary students for the best clinical reports submitted in its contest (see VETERINARY MEDICINE, January 1950, page 41).

Since this contest was announced, considerable interest has been mainfested. A large number of excellent papers were presented, most of which reflect favorably on the authors' scholastic training and powers of observation. Only by careful study were judges finally in unanimous agreement. The five men listed below, to whom checks in the amounts opposite their names have been mailed, are to be congratulated.

First Prize: $100.00
Desmond H. Hill
Ontario Veterinary College
Guelph

Second Prize: $50.00
Howard G. Senter
School of Veterinary Medicine
Tuskegee Institute, Alabama

Third Prize: $25.00
James L. Palotay
Kansas State College
Manhattan

Four Prize: $15.00
Jay H. Miller
State College of Washington
Pullman

Fifth Prize: $10.00
William C. Gross
Kansas State College
Manhattan

The purpose of this contest was to encourage those students who will be admitted to the fraternity of graduate veterinarians in a matter of weeks, to contribute to scientific literature and to learn early the value of reporting the lessons of their experience. The first place report will be published in an early issue.

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Secretary of Agriculture Charles F. Brannan has announced that the Department has signed an agreement to option a site on Prudence Island, a part of Rhode Island situated in Narragansett Bay, for the proposed extensive laboratory facilities to be used by the Department in the study of foot-and-mouth disease of domestic animals.

American Animal Hospital Association Denver Meeting

A full program of practical interest prepared for visiting veterinarians was enthusiastically commended by those in attendance at Denver. Excellent accommodations for the sessions, educational exhibits and commercial displays added to the enjoyment of all.

Dr. J. Raymond Curry

Dr. J. Raymond Curry, practitioner, Washington, D. C., was selected as president for the ensuing term and Dr. Ralph Ruggles, Moline, Ill., as 1st vice-president. Dr. Wayne H. Riser was re-elected executive secretary and Dr. A. R. Theobald, treasurer.

Members of the A.A.H.A. will meet with the small animal section of the A.V.M.A. at Miami Beach in August and in annual session at Atlantic City, N. J. in 1951.

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Dicoumarin, occurring in spoiled sweet clover hay, and the agent responsible in sweet clover poisoning, is prepared synthetically (dicumarol) and used as an anticoagulant in thromboses.

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Methoxychlor gave results equivalent to DDT as an insecticide spray for dairy barns. On painted wood surfaces, Robert J. Dicke, of the Wisconsin Station, found the methoxychlor lost its killing power after 60 days, while the DDT lasted 120 days.

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Ascites and edema in turkey poults under 21 days of age, appeared to be caused by an excessive intake of sodium salts contained in feed and water.—Bigland, C. H., *Can. Jour. Comp. Med.*, 14:144 (Apr.), 1950.

POULTRY PRACTICE PROBLEMS

W. R. HINSHAW, D.V.M., Ph.D.
Frederick, Maryland

Mechanically operated, automatic feeders for poultry are now in common use on many poultry farms. The usual type used is operated like an automatic coal stoker, which carries the feed from a central feed hopper along the length of the feeding troughs for 100 feet or more. The advantages claimed for them over hand feeding include; a fresh supply of feed available at all times, better distribution of feeding time for layers, thus reducing crowding at the feed hoppers, and more uniform feeding, especially of so-called timid birds. A discussion of mechanical *versus* hand feeding methods is given by Bressler, *et al.*, in *Poultry Science*, 29:176 (March), 1950.

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Brynn, *et al.*, (*Poul. Sci.*, 29:167 [March], 1950) have described a method of treating turkey blood serum to remove or reduce the lipid material responsible for the marked clouding of some samples, which causes interference with the reading of tube agglutination tests. Their method consists of treating the cloudy serum with ethylene dichloride which removes about 95% of the lipid substance. Equal parts of cloudy serum and ethylene dichloride are mixed and allowed to stand for 12 hours. The ethylene dichloride fraction collects at the bottom of the tube, and the non-lipid aqueous portion can be removed from the surface and used for the test. Apparently the agglutination titer of the serum is not affected by the procedure.

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South Africa claims an international egg-laying champion. A Black Australorp hen entered in a South Africa egg-laying contest laid 354 grade A eggs and one grade B egg in 365 days. Other hens have laid more eggs but it is doubtful, according to D. W. Plessis, (*Farming in South Africa*, 23:309, 1948) if any has laid as high a percentage of grade A eggs in a one-year period.

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Advice on rodent control will be welcomed by your poultry clients and will do much to help them prevent poultry diseases. A good bulletin on methods of rat-proofing buildings is U. S. Fish and Wildlife Service Conservation Bulletin No. 19.

Sunflower seed oil meal was found by Gratley, *et al.*, (*Poul. Sci.* 29:312, 1950) to be a satisfactory protein supplement for the growth of turkey poults when used at a level of 21% or less in a 28% protein starting diet fed for the first four weeks. From four to six weeks up to 16.5% of the sunflower seed meal gave good growth in a 26% protein mash.

Although satisfactory growth rates were obtained with these levels of sunflower seed oil meal, the incidence of white feathers in poults increased progressively as soy bean meal was replaced by sunflower seed oil meal. The authors concluded from these results that the level of lysine, which is low in sunflower seed oil meal, necessary to produce normal pigmentation is higher than that required for maximum growth.

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Chick embryo mortality may be due to insufficient turning of eggs during the hatching period. Experimental work done at the University of Kentucky indicates that the hatchability could be increased as much as 12% by increasing the number of turns per day from two to eight. At least five times per day is recommended and if an automatic turning device is in use on the incubator, eight to 12 times will be found profitable. Eggs should be incubated with the large end up to insure maximum hatchability.

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Sulfonamide drugs have become of definite economic value in controlling many diseases of poultry. They must, however, be used as adjuncts to a program of sanitation and other good management practices and not as substitutes for these practices.

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A good poultryman is able to produce a four pound chicken in 12 weeks with 12 pounds of feed. Ten years ago, he considered that he had excellent results if he produced a three pound chicken in 12 weeks on 11 pounds of feed (Termohlen, *World's Poul. Sci.*, 6:35, 1950).

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The per capita consumption of poultry meat by Canadians in 1948 was as follows: 15.9 pounds of chicken; 2.84 pounds of turkey; 0.32 pounds goose and 0.17 pounds duck.

VETERINARY PARASITOLOGY

A. O. FOSTER, B.A., M.A., Sc.D.
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Pork and Beef Tapeworms

A report* from the Philippine Bureau of Animal Industry deals with a mysterious aspect of animal cysticercosis and human taeniasis to which parasitologists and veterinarians have often made reference. In the Philippines, as in other countries, the seemingly indisputable fact is that porcine cysticercosis is comparatively common, although human infection with *Taenia solium* is rarely encountered; conversely, that bovine cysticercosis is a rare phenomenon, yet human infection with the beef tapeworm, *T. saginata,* is of relatively common occurrence. Reviewing a considerable body of literature and experience, the authors concluded that 63 authentic human cases of taeniasis had been reported from the country; 57 were *T. saginata* and six, *T. solium*. On the other hand, their report describes what is regarded as the first recorded indigenous case of *Cysticercus bovis*. Previously, in 1916, this had been reported from two beef animals imported from French Indo-China. A detailed study of swine cysticercosis, covering a 25-year period, revealed an over-all incidence of almost 1%; among 3,361,580 hogs slaughtered, there were 31,852 cases of *Cysticercus cellulosae*.

To account for the mysterious inverse relationship between the incidence of cysticercosis in animals and taeniasis in man, some interesting suggestions are offered. For example, swine are coprophagous and cattle are not. Thus, the chance of acquiring infection by swine is greatly enhanced while cattle become infected only accidentally. Also, pigs are slaughtered at a comparatively early age, well before any degeneration of cysts can occur, while cattle are slaughtered at maturity, after all cysts acquired as much as two years previously have undergone complete resolution. There is, moreover, the observation that pork is customarily well-cooked, while beef is often eaten rare. The report does not refer to the possibility, suspected by some parasitologists, that undetected cases of human infection with *T. solium* may exist in families of hog raisers.

*Refuerzo, P. G., and Albis, F. S., *Cysticercus bovis* and *Cysticercus cellulosae* in Animals with Notes on Human Taeniasis in the Philippines. *Philippine Jour. An. Ind.*, 9:123, 1947.

Host Metabolism and Poultry Coccidiosis

Induced hyperthyroidism of chickens appears to favor the development of *Eimeria tenella*, the causal organism of cecal coccidiosis[1]. Infected birds, whether on a basal ration or one fortified with thyroprotein (0.04% protamone), suffered comparable setbacks in growth, although those on the thyroprotein supplement exhibited higher oocyst production. On the other hand, uninfected chickens on a basal ration gained about as rapidly as those on the ration fortified with thyroprotein. Moreover, there is some evidence[2], however meager, that induced hypothyroidism (from diets containing 0.1% of 6-methyl thiouracil) may offer less protection than thyroprotein (0.02 to 0.04%) against the injuriousness of the infection. Of chief practical significance may be the fact that broilers and other chickens reared on feeds containing thyroprotein supplements probably contribute to coccidial contamination of premises to a greater extent than those reared on basal rations.

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Eimeria meleagrimitis, the most injurious species of coccidia in turkeys, has been found to pass through two asexual generations in the host, followed by a third predominantly sexual generation, and a fourth generation initiated by a few third-generation merozoites. Oocysts appear on the fifth day. The infection affects primarily the middle third of the small intestine but does not appear to produce hemorrhage.

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Although acaprin, a recognized specific in the treatment of piroplasmosis, has been reported to be of value in the treatment of anaplasmosis[4,5], the data at hand do not show that this or any other available drug destroys the organism that causes the disease.

[1]Todd, A. C., *et al. Poul. Sci.*, 28:549-551 (July), 1949.

[2]Wheeler, R. S., *et al. Jour. Am. Vet. Med. Assn.*, 112:473-474 (June), 1948.

[4]Pulling, Fred B. *Jour. Am. Vet. Med. Assn.*, 115:46 (July), 1949.

[5]Turgut, A. *Wien. Tierarztl. Monatschr.*, 23:737, 1936.

CLINICAL REPORTS

Cesarean Section in a Ewe

T. A. NEWLIN, D.V.M., and H. J. MOSTYN,
Dover, New Jersey

Pregnancy disease in ewes, known otherwise as lambing paralysis, old ewe disease, ketosis, twin lamb paralysis, toxemia of pregnancy, acidosis of pregnant lambs, etc., occurring principally in farm flocks, almost never in range ewes, is manifested primarily by symptoms of a nervous character.

Ketosis is but one of the symptoms. Urine analysis will disclose a positive reaction to the reagents used to determine the presence of acetone. Treatment to relieve the symptoms of ketosis will ordinarily effect recovery only during the earliest stages of the disease process. Negative tests for ketosis in advance cases do not forecast satisfactory recovery.

Pregnancy disease occurs from two weeks prepartum until the day of lambing. On autopsy of animals dead of the disease, the liver is invariably yellowish-tan. Accumulations of fat in the liver cells are responsible for the color changes. The consensus is that outbreaks occur chiefly in flocks maintained on low quality feeds, particularly those that do not supply sufficient carbohydrates. Many outbreaks, however, occur in flocks supplied adequate quantities of good feed and in these instances, lack of exercise during the latter part of pregnancy is suggested as predisposing. The observation has been made that in selected flocks forced exercise will arrest an outbreak.

In the early stages, ewes affected are less active than other members of the flock. They walk with a stiff, slow gait and have difficulty in rising. They may walk in a circle or stand with the head pressing against fixed objects. As the disease progresses, complete paralysis, cloudiness of the cornea, persistent grinding of the teeth, refusal of food and water are symptomatic. Finally victims become comatose. The course of the disease may run from several hours to a week. Where the ewes lamb in the interim, many cases make spontaneous recovery.

The case reported deals with a purebred Hampshire ewe that first manifested symptoms on February 22. At that time stiffness of gait was observed. The ewe was isolated and the following treatment instituted: On February 22, 45,000 units of thiamine hydrochloride were injected. This was repeated on February 23 with 80 cc. of 50% dextrose administered subcutaneously. One pint of molasses in a quart of lukewarm water was given as a drench every six hours.

On February 24, 40 units of protamine zinc insulin were given. The carbohydrate treatment was continued. On February 25, the dextrose injection was increased to 120 cc., and 40 units of protamine zinc insulin were again administered. On February 26, the insulin was doubled to 80 units and 8 oz. of glucose added to the aforementioned molasses and water. The dextrose solution was again repeated. The thiamine hydrochloride was also continued. Urine specimens taken on February 26 and 27 were negative for acetone bodies.

The ewe had refused food and water for four days. She was due to lamb on March 3 and as anorexia persisted on February 28, a cesarean section was decided upon. The ewe was moved to the Dover Animal Hospital where she was placed upon the operating table. The region of the right flank was clipped and the operative site scrubbed with tincture of green soap for several minutes and then scrubbed with 70% alcohol. A sterilized sheet of muslin was prepared to cover the operative field so that no portion of the uterus or other viscera protruding from the incision would come in contact with the skin or wool.

The mark for incision was made, beginning above at a point about midway between the last rib, the margins of the lateral processes of the lumbar vertebrae, and the supero-external tuberosity of the ilium, and extended downward and obliquely forward for a distance of eight or nine inches. An 18 gauge 2 inch needle was inserted in the line of incision and passed upward. Infiltration of the area with 2% procaine was made as the needle was slowly withdrawn downward through the anesthetized field. Allowing 15 minutes for complete anesthesia, the incision was made with a no. 10 Bard-Parker knife. A straight, clean cut was made through skin, fascia, muscle, and the peritoneum, exposing the small intestines. The small intestine was pushed to one side and held by sterilized packs. The right horn of the uterus was pulled up to incision and opened

with the knife and the opening extended with scissors. The edges of the uterus were held with forceps and the fetus quickly removed and handed to an assistant. Even though this was four or five days before the normal lambing date, the fetal membranes were removed without difficulty. Going through the body of the uterus and into the left horn another fetus was discovered and delivered.

The incision in the right horn of the uterus was closed with a double row of interrupted sutures, turning the edges of the wall well inward. A sulfanilamide-sulfathiazole powder (50% each) was generously applied in the abdomen and the muscles closed with interrupted sutures using no. 000 boilable catgut. More of the sulfonamides were applied and the skin closed with silk sutures.

To reduce shock, 500 cc. of a dextrose-saline solution was given subcutaneously and 1.5 cc. of coramine administered as a respiratory stimulant.

The ewe was removed to home quarters and aside from repeated doses of coramine at four hour intervals (1.5 cc.), no other medication was given.

The following morning, another 500 cc. of dextrose-saline solution was administered. It was observed at this time that the rate of flow of the parenteral solution was much more rapid and it appeared that the subcutaneous tissue had lost its ability to retard the intake of the solution. The ewe died about an hour following the injection.

Summary

The use of insulin in conjunction with carbohydrates proved efficacious in this case by eliminating the ketosis. The opinion is expressed that acetone appears in the urine at the onset of pregnancy disease due to faulty fat metabolism and as the animal refuses food the severity of the ketosis increases due to tissue starvation. Coma preceding death in the case reported did not develop as the symptoms of ketosis had been arrested without any apparent benefit to the animal.

Two per cent procaine proved an excellent local anesthetic.

The twin ram lambs delivered by cesarean section are vigorous and developing normally in growth by artificial feeding.

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The natural instinct of domestic and wild animals to devour placenta may serve to provide lactogenic hormones.—*Ellis P. Leonard, D.V.M.*

Blackleg in Swine

E. L. EGGLESTON, D.V.M., Alcester, South Dakota.

American veterinary literature contains very little information as to the prevalence of blackleg infection in swine. Blackleg in swine is not a common disease. Breed[1] reports on the isolation of the organisms from tissues submitted to the laboratory. Heller[2] states that gas phlegmon in swine is usually caused by *Clostridium septicum*. The differentiation of blackleg and malignant edema infections is often difficult to make in the field.

History

The writer was called to a farm, where a calf had died of probable blackleg ten days before the disease appeared in the pigs. The carcass had been consumed by the hogs. At the time of the visit, three pigs were dead but only one sick. They were Duroc Jerseys, four to five months of age, weighing from 100 to 140 pounds.

Symptoms

The sick and dead animals showed extensive edematous swellings of the face and throat region, including the ears, the swellings appearing in all pigs in the same place. Ears were greatly thickened but were not oozing. The sick pigs showed temperatures of 104 F. to 108 F. There was no evidence of suffocation. However, since this was in an anthrax area, a laboratory diagnosis was indicated. Anthrax in swine usually produces changes in the lymph glands in the region of the throat. There was not much gross change in the lymph glands of these pigs on postmortem examination.

Laboratory Findings

The cutaneous tissues of the throat, face and ears contained large amounts of fluid. The muscles were black and gaseous, with an odor of a butyric-acid nature, resembling rancid butter.

Cultures made from the muscles produced a growth of an organism resembling that of blackleg. Guinea pigs injected with this culture died with lesions of blackleg. Rabbits injected with the culture did not die.

Interesting Facts

The herd was being fed from self-feeders. There was an aluminum strip covering the edges of these feeders. This was rough and badly worn in places, producing many sharp edges. The aluminum strip was removed, thus preventing a possibility of producing any

abrasions on the animals during eating. Only one animal developed a swelling after this was done.

Treatment

Six of the sick animals were given sulfonamides by mouth and injectable sulfonamide combinations. All of this group died.

One pig was injected with 1,000,000 units of penicillin in oil and wax; it died two hours later.

Three pigs were given 400,000 units of penicillin in water and this dose was repeated eight hours later. Of these, all recovered.

All pigs not showing symptoms were vaccinated with *Cl. chauvei-septicum* bacterin. The dose was three-fourths that recommended for cattle. Injections were made in the axillary space. All the animals became very stiff for 48 hours following vaccination, but no more died. All cattle were vaccinated with the same type of bacterin the same day.

Penicillin given in dosages of 2,000 units per pound of body weight appears to be of benefit in pigs affected with blackleg.

REFERENCES

1. Breed, Frank, Blackleg in Hogs. *Norden News*, Nov.-Dec., 1946.

2. Heller, H. H., Jr., Etiology of Acute Gangrenous Infection of Animals: A Discussion of Blackleg, Maligmant Edema and Whole Septicemia. *Jour. Inf. Dis.*, 27:422, 1920.

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Losses in Lambs Dipped in Benzene Hexachloride

KARL S. HARMAN, D.V.M.,* and
LOREN D. KINTNER, D.V.M.**

In November 1949, a flock of 75 ewes and one ram was observed by the owner to be scratching and losing patches of wool. They were dipped once in warm commercial lime-sulfur solution of about 1:20 dilution. They had not started to lamb and no bad effects were seen from this dipping. A few weeks later they were observed to be scratching and veterinarians of the BAI were consulted. Examinations revealed the mites of sheep scab, *Psoroptes equi.* var. *ovis.* On February 3, 1950, the flock containing 75 ewes, one ram and 15 lambs, was dipped in wettable benzene hexachloride (BHC) containing 12% gamma isomers. Four pounds of the BHC were used to each 100 gallons of water to make a dip containing .06% gamma isomers. The ewes and the ram were held in the dip about two minutes and the lambs were held one minute. The owner reported one lamb dead the next morning after the dipping and several sick. The age of the lambs ranged from two days to one month. The younger lambs were the first affected and ten of 15 died. Nervous symptoms were the most prominent. Vision was impaired and they would not nurse. They exhausted their energy running crazily back and forth, bumping into and pressing against objects. A few hours of coma preceded death. The adult sheep showed no ill effects after the dipping but seven of the ewes gave birth to dead lambs and then the incidence of dead lambs dropped off for the rest of the lambing period. One ewe had gangrenous mastitis and died. This is not unusual in any lambing flock.

Three lambs, one week of age, all of which were showing nervous symptoms described, were brought to the Missouri Veterinary Clinic. Lamb no. 1 died February 7; lamb no. 2 died February 8; lamb no. 3 died February 9. Lamb no. 3 was autopsied immediately after death, while lamb no. 1 and lamb no. 2 were not autopsied until 24 and four hours, respectively, after death.

In each case, the stomach and cecum were greatly distended with gas. The intestines were only moderately distended, probably due to atony of the intestinal tract.

The liver and lungs were hyperemic. One liver which was sectioned showed a mild fatty metamorphosis. Microscopic sections of the cerebrum were essentially normal.

No other gross pathology was noted. The stomach and its contents from the first lamb to die were fed to crickets by P. C. Stone of the Entomology Department. None of the crickets died, this fact indicating that the concentration of BHC in the stomach was very low, if not absent.

Furman[1] reported that lethal doses of BHC fed mice caused hemorrhagic gastritis and in some cases duodenal enteritis with the intestinal tract swollen with gas and food. However, when the mice received the lethal dose of BHC by subcutaneous injection no gross pathology was noted.

The gamma isomer acts as a central nervous system stimulant. The alpha, beta, and delta isomers act as depressants. The latter isomers have very low toxicity for insects and arachnoids; consequently, the manufacturers attempt to keep the concentration low in the BHC.

The gamma isomer is not accumulated to any great extent in the body. Welch[2] fed two sheep 2.25 gm. of BHC (10% gamma isomer)

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daily for 60 days. After 20 days, both sheep exhibited slight nervousness and incoordination which disappeared but recurred from time to time. One sheep lost three pounds. The other sheep gained two pounds.

Only a trace of the BHC is excreted via the urine and feces. One site of detoxification appears to be the liver. Lang[3] incubated minced liver in a solution of the gamma isomer. Within two hours there was a 25% reduction of the gamma isomer. It is an interesting observation that the liver enlarges by about 25% in rats getting 500 p.p.m. gamma isomer in their feed.

Radeleff[4] reports that BHC is toxic to lambs from two days to one month of age when the gamma isomer content of the dip approaches 0.15%. The lambs were quickly immersed, held for several seconds, then released. Perhaps the length of time the lambs are in the solution is as important as the concentration of the solution. Another important factor is the amount of BHC the lamb ingests by nursing while the ewe is still draining after being dipped.

REFERENCES

1. Furman, Deane P., Toxicity of Benzene Hexachloride to Mammals. *Jour. Econ. Entom.*, 40:518, 1947.
2. Welch, Howard, Tests of the Toxicity of Sheep and Cattle of Certain of the Newer Insecticides. *Jour. Econ. Entom.*, 41:36, 1948.
3. Lang, Edwin P., Tissue Distribution of a Toxicant Following Oral Ingestion of the Gamma Isomer of Benzene Hexachloride by Rats. *Jour. Pharm. Exp. Med.*, 93:277, 1948.
4. Radeleff, R. D., Personal communication, 1950.

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Rapid Diagnosis of Neoplasms

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A seven-year-old Pointer bitch was admitted to the hospital presenting an abnormal mass of tissue involving the number 4 right mammary gland. The enlargement was firm and nodular and measured 5½x4¾x2½ inches. The abnormal mass of tissue was diagnosed as a mammary tumor and excision was advised. The area was prepared for surgery and local infiltration of the tissues above glands 4 and 5 with 1% procaine hydrochloride was used to produce anesthesia. Much of the cutaneous hemorrhage was controlled by crushing the skin along the proposed line of incision with a Burdizzo forceps. The incision through the skin and subcutaneous tissue was made along this line and only the larger vessels were ligated. Malignancy was suspected and glands 4 and 5 were removed, along with the corresponding inguinal lymph node.

The tumor was removed and examined for histologic detail by the rapid method. The specimen was fastened by two nails to a board and was cut with a straight biconcave razor. Relatively thick sections were cut from the specimen and were stained superficially, on one side only, with Terry's neutral polychrome methylene blue. The stained surface of the moist section was covered with a cover slip and immediately examined with artificial light. Both high and low powers of the microscope were used. Upon examination, the section had the appearance of a thin microtome section, as only the upper cellular layer was stained, and the light was transmitted through the thick, unstained portion. Mitotic figures were present in large numbers, denoting a malignant condition. Connective tissue and muscle fibers appeared as light rose and the nuclei were stained deep blue. This microscopic picture began to fade slowly in five or six minutes. The rapid process is so simple that in less than a minute the tissue may be cut and stained.

It would not be practical to undertake the rapid tissue diagnosis in all cases where gland 4 is involved, as most surgeons prefer to remove both glands 4 and 5, and the inguinal lymph node, due to the close proximity, and frequency of carcinomas. Microscopic examination would no doubt aid in determining prognosis. When gland 3 is involved, it may be advisable to undertake microscopic examination to determine if removal of not only the tumor but glands 1, 2, and 3 of the affected side is indicated, and possibly the axillary lymph node as well, since the lymphatic drainage from glands 1, 2, and 3 flows anteriorly. If gland 3 is extensively involved and the tumor encroaches on gland 4 it must be determined if removal of all the glands on the affected side would be indicated.

The method of designating the individual glands as presented in this paper was suggested by Stalker and Schlotthaur. As most bitches have five pairs of nipples and glands, they suggested the numerical system which is to simply number the glands, from before backwards, as glands 1, 2, 3, 4 and 5. When only four pair of glands are present, it is usually the third pair which is absent.

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An arsonic acid derivative is reported to be another growth stimulating substance when added to chick rations. This factor added to vitamin B_{12} and aureomycin is the third potent growth accelerator revealed in recent nutritional investigations.

ABSTRACTS OF LITERATURE

Immunizing Value of Hamster-Adapted Pneumoencephalitis Virus (Newcastle Disease)[19]

Hamster-adapted strain of pneumoencephalitis (Newcastle disease) virus prepared from the 73rd hamster passage was injected intracerebrally into selected hamsters. These animals were sacrificed when typical symptoms of central nervous system involvement appeared in 48 to 72 hours. Ten per cent suspensions (0.15 cc.) of brain tissue from these animals were inoculated into the allantois sac of eight-day-old chick embryos.

Allantoic fluid from the hamster-egg passage, used as a vaccine, was pathogenic for chickens to the extent of 8.33% when injected by the subcutaneous route and 3.33% by the stick method. On challenge of immunity, 3.44% of chickens vaccinated by the stick method became infected and none of the group vaccinated subcutaneously developed the disease.

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Uterine Perforation in a Mare Successfully Treated with Sulfonamides

The use of sulfonamides in dystocia of mares reduced the fatality rate in these animals from 50% to 10% at the Veterinary College of Hannover[20]. Infections in the uterus of mares are due chiefly to streptococci and staphylococci. In these cases 10 to 15 gm. of prontosil is recommended, given subcutaneously, as 5% aqueous solution, one to three times daily. In the case of a mare suffering perforation of the uterus followed by peritonitis, 100 cc. of a sulfonamide compound solution (baludon, B 1105, 60% strength) was injected through the perforated wound into the abdominal cavity. The wound was then sutured and sulfonamide injections repeated intraperitoneally, in the same doses, on the third, fourth, and fifth days after surgery. Even though this case seemed to be hopeless, complete recovery resulted.—G. L.

[19]Reagan, Reginald L., Hartley, Janet W., Werner, Helen Odette, and Brueckner, A. L., Immunological Studies of Embryo-Propagated Hamster Adapted Newcastle Virus in Chickens. *Proc. Soc. Exp. Bio. & Med.*, 73:241 (Feb.), 1950.

[20]Aehnelt, E., Cure of a Uterus Perforation in a Mare Due to Intra-abdominal Use of Sulfonamides. *Deut. Tierärztl. Wochenschr.*, 57:27, 1950.

New Technic of Semen Collection for Artificial Insemination of Cattle[22]

In instances where bulls will not serve an artificial vagina, the author proposes modifications so as to make possible its introduction into the vagina of a cow. Best suited for this procedure are females with wide genital organs, especially older animals who have produced calves. The lubricated artificial vagina is introduced into the animal's cleaned vagina under epidural anesthesia. To avoid its slipping too deep, a metal ring is fastened to the posterior end. The modified instrument proved very successful for the utilization of the semen of bulls that had repeatedly refused to use the ordinarily employed apparatus.—G.L.

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Treatment of Infectious Leukopenia in Cats

Panleukopenia in cats occurs in two forms, *i.e.*, pulmonary and gastrointestinal; in dogs, a third, nervous form exists. More recently a similar disease condition has been observed among cats which also shows the symptoms of feline typhus. It is highly contagious, has a high mortality rate, and is now called infectious leukopenia[23]. Two sick cats were treated successfully with (1) penicillin, (2) a vaccine prepared from organs of cats that had died of the same disease, (3) polyvalent serum, and (4) symptomatically, while a control animal died after a few days.—G.L.

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Fradicin, New Antifungal Agent

Another new antibiotic, designated fradicin, found to be active only upon fungi, has been isolated from the culture filtrate of the neomycin-producing organism, *Streptomyces fradiae*[24]. Fradicin is characterized by an antifungal spectrum, which includes animal pathogens including *Aspergillus niger* and *Candida albicans*.

[22]Briere, J., A New Technic for Collecting Semen from Bulls for Artificial Insemination. *Die Veterinärmed.*, 2:110, 1949; *Bul. VAcad. Vet.*, 22:195, 1949.

[23]Cathelineau, P., Observations Regarding the Treatment of Infectious Leukopenia in the Cat. *Die Veterinärmed.*, 2:18, 1949; *Bul. VAcad. Vet.*, 22:107, 1949.

[24]Swart, E. Augustus, *et al.*, Fradicin, an Antifungal Agent Produced by *Streptomyces fradiae*, *Proc. Soc. Exp. Bio. & Med.*, 73:376 (Mar.), 1950.

BOOK REVIEWS

Books reviewed in this department and any other books, if available, may be obtained by remitting the published price to the Book Department, Veterinary Medicine, Suite 803 Livestock Exchange Building, Kansas City 15, Missouri.

PROCEEDINGS OF THE FIRST CLINICAL ACTH CONFERENCE, *John R. Mote*, M.D., Director, Armour Laboratories, editor; 178 contributors. 624 pages, 414 illustrations. The Blakiston Company, Philadelphia 5, Pa. and Toronto 2, Canada, publishers, 1950.—Price $5.50.

This volume comprises a complete report of the clinical ACTH conference held in Chicago in October 1949, under the sponsorship of the Armour Laboratories. Fifty-two papers were presented and much discussion from the floor ensued. Attendance at the conference was limited to ACTH (adrenocorticotrophin) investigators and associates.

The introduction in rapid succession of the "wonder drugs," the sulfonamides, the "miracle drugs," the antibiotic agents, the superlatively efficient insecticides, and shall we include the overly touted antihistamines, have conditioned all branches of the medical profession, and the general public too, to just about anything in therapeutic claims. Nevertheless, if ACTH lives up to some of its early promises, the admonition of the victim of delirium tremens to the big game hunter, "you ain't seen nothin' yet" will apply.

Since the earlier studies of this hormone were concerned with metabolic balance, a substantial amount of information as to the physiologic and metabolic effect of stimulating adrenal glands in normal individuals and those with endocrine defects was presented. Two disease syndromes, gout and myasthenia gravis, have received a two-year study which shows that the clinical status of the patient is materially changed as a result of adrenal cortical stimulation by ACTH. The effect of this agent in rheumatoid arthritis, nephrosis, cancer, adrenal hyperplasia, hypertension, lymphoid tumors, leukemia, rheumatic fever, ulcerative colitis, allergic diseases, pulmonary tuberculosis, poliomyelitis, and various other pathological conditions had been studied for less than a year at the time of the conference and only preliminary and tentative conclusions could be drawn. However, the marked effect of ACTH on widely divergent syndromes reveals that something fundamental and heretofore unknown in physiology has been encountered.

This volume presents the basic information upon which future developments must rest. It seems inescapable that a new avenue of therapy has been opened up. The present supply of ACTH is extremely limited; the cost high. It is not available for the treatment of animals, but may be later. When available, it will afford a spectacular line of therapy with which all engaged in practice and research must be familiar.—D.M.C.

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SOME IMPORTANT ANIMAL DISEASES IN EUROPE, arranged and edited by *K. V. L. Kesteven*, D.V.M., Chief of the Animal Industry Branch of the Agricultural Division, FAO. 193 pages; paper bound; published by the Food and Agricultural Organization (FAO) of the United Nations; 1201 Connecticut Ave., N. W., Washington 6, D. C., 1949.—Price $2.00.

This volume, which is no. 10 of FAO Agricultural Studies, comprises the 21 papers and essential parts of the extemporaneous discussions presented at the annual disease conference held in Warsaw, Poland, in 1948, under the auspices of the FAO.

During World War II, there was very little exchange of information among the veterinary services and laboratories in many parts of the world. This 12-day conference was held to provide the opportunity for veterinarians of various countries to get together and discuss the latest methods of animal disease control. The contributors to the program included the leading veterinarians—chiefs of the veterinary services and heads of the state laboratories—of nine nations and also prominent veterinarians of several other countries who took part in discussion from the floor. In addition, the conference was attended by Ralph W. Phillips, Deputy Director, Agricultural Division, FAO Washington, D. C., and Martin W. Kaplan, Public Health Officer (Veterinary), World Health Organization, Geneva, Switzerland.

Several of the diseases discussed, *e.g.*, swine erysipelas, hog cholera, brucellosis, bovine mastitis, and avian pneumoencephalitis are as important to American veterinarians as they are to those attending the conference and this opportunity to obtain copies of these discussions by the highest authorities will be appreciated.

Many attention-compelling statements occur in this volume. Examples are: (1) Swine erysipelas is far more important in Europe than hog cholera as a cause of loss in swine. (2) The serum culture method of vaccination against swine erysipelas (the method employed in the United States) was formerly used extensively in Europe, but has fallen into disfavor because it failed to prevent the spread of the disease. In Switzerland, where this method for control of swine erysipelas was generally employed, the incidence of the disease increased 75% in seven years. Three vaccines, none of which contain living organisms, are used now. (3) In Czechoslovakia, porcine virus encephalomyelitis (Teschen disease), a disease unknown until recently, killed 150,000 swine in a single year. (4) Brucellosis was practically eradicated from Norway in 12 years (1936 to 1948) at a cost of approximately $300,000. (5) European observers have reported a 50% decrease in the mortality from avian pneumoencephalitis during the past two years.—D.M.C.

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PLANNING YOUR ANIMAL HOSPITAL, by *Hospital Building and Equipment Committee* of the American Animal Hospital Association. 160 pages A.A.H.A. Executive Office at 5335 Touhy Ave., Skokie, Ill., publishers, 1950. — Price $3.50.

Prepared to meet the demand for information on new construction of small animal hospital facilities, this little book offers a guide for building that should serve to answer many questions of those contemplating construction or remodeling. For these the book is recommended as containing many valuable ideas that have successful precedent.

Material for the book was gathered by a group of members of the A.A.H.A. and assembled and edited by Dr. Wayne H. Riser, executive secretary of that organization.

Exterior and interior views and floor plans of some of the finest and most elaborate hospitals now operating profusely illustrate the text material.

VITAMINS AND HORMONES, VOL. VII, by *Robert S. Harris,* Professor of Biochemistry of Nutrition, Massachusetts Institute of Technology, and *Kenneth V. Thimann,* Professor of Plant Physiology, Harvard University. 488 pages, Academic Press Inc., New York, publishers, 1949. —Price $7.80.

This is a compilation of 13 articles on the advances in research and application of vitamins and hormones, written by 15 experts from Europe and America. Each article is followed by a complete list of references. Among the contributions are to be mentioned the following as of interest to veterinarians engaged in research work: Physiology of thiamin; niacin in amino acid metabolism; diet and aging; chemistry of gonadotropic hormones; chemistry and physiology of adenohypophyseal luteotropin (prolactin); chemistry of the hormones of the posterior lobe of the pituitary gland; actions of the hormones of the posterior lobe of the pituitary gland upon the circulation and the secretion of urine. Much space is given to the many confusing and contradictory discussions about the so-called vitamin P which probably embraces a group of compounds having effect on (capillary) permeability. • • •

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New Book Prices

The recent devaluation of the British pound has made possible substantial reductions in the prices of certain British veterinary books effective May 1, 1950.

Index of Diagnosis for the Canine and Feline Surgeon, by Hamilton Kirk, M.R.C.V.S. Was $10., now $8.

Index of Treatment in Small Animal Practice, by Hamilton Kirk, M.R.C.V.S. Was $10., now $8.

Hobday's Surgical Diseases of the Dog and Cat, 6th ed. Edited by James McCunn, M.R.C.V.S. Was $6., now $4.50.

Veterinary Helminthology and Enthomology, by H. O. Mönnig, B.V.Sc. Was $9., now $7.

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What appears to be the first such course of college instruction, dog husbandry, is offered at the Clarence Pierce Agricultural College, Canoga Park, Calif. The weekly two-hour course is conducted by Mr. R. E. Barrett, Boxer fancier and dog magazine publisher. Visiting lecturers include veterinarians, breeders and handlers. Over 100 men and women attend the sessions regularly.

For you, Doctor...

Here is another of the news features telling the story of veterinary service in over 2,600 newspapers, coast to coast. This year-round public relations campaign for the profession now embraces pictures, cartoons, news articles, farm journal advertisements, radio, and motion pictures . . . to tell YOUR story . . . to help increase your practice.

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VETERINARY ITEMS OF INTEREST

Dr. Carl Cozier Honored

In recognition of his 21 years of service as director of the local school system, Dr. Carl Cozier, CVC '05, Bellingham, Wash., was honored by the Board of Education in naming a new facility under construction, the Carl Cozier Elementary School.

▼

At least two conditions in the present state of our knowledge that seem to make difficult a clear interpretation of the results of the so-called brucellosis ring test are; (1) when an animal has been subjected to adult vaccination there are agglutinins in the milk that make an exact interpretation difficult; (2) animals with mastitis, and those that give abnormal milk do not give clear reactions.

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Gaines Dog Research Center is authority for the statement that dogs in the United States now number 22,000,000, owned by 17,000,000 families.

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It is poor agricultural economy to live with a surplus of corn and other useful livestock feeds and at the same time market unfinished meat animals of low quality.

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During the calendar year 1949, commercial Brucella vaccine, strain 19, representing a total of 3,750,000 doses, was tested by the BAI and released for marketing.

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Bureau entomologists have posted a warning notice to stockmen that heavy infestation of screwworm flies, *Callitroga americana,* is imminent this season because mild winter weather did not kill parasites over a wide south and south-central area.

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Federal meat inspectors made postmortem examinations on 83,466,935 animals in 1949, of which number 286,623 were condemned for human food.

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A synthetic chemical with the insect-killing power of pyrethrum has now been made on a commercially practical scale.—*S.N.L.*

The average farm flock produces from 130 to 162 eggs per year per hen. Many commercial flocks average 200 eggs per hen per year. A hen laying 200 eggs per year requires about 200 pounds of feed, 100 pounds for maintenance and 100 for the eggs. A total of one pound per egg produced. A 130-egg hen requires 90 pounds of feed for maintenance and 65 pounds for egg production, a total of 155 pounds or approximately 1.2 pounds per egg. Thus, to produce only one case of eggs per day, the less efficient layers require a ton of feed per year more than the 200-egg birds.

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Graduates of medical, dental, pharmacology and veterinary colleges who participate in the medical R.O.T.C. program of the U. S. Army may now receive commissions in the Medical Service, U. S. Air Force Reserve, according to a recent agreement between the Army and the Air Force.

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Since its appearance last year, the variant virus of hog cholera, reported to be responsible for some losses in vaccinated pigs, has been found by field and laboratory studies by the BAI to be unstable in nature and to have a marked tendency to revert to the regular virus.

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Though there is reasonably clear-cut evidence that 48-hour observation following an intradermic tuberculin injection is just as accurate as the conventional 72-hour reading, the latter is still the only officially acceptable one in the United States.

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The total waste of meat in the process of marketing, including condemnations for disease, was approximately 158,000,000 lb., and the loss $91,000,000. in 1949.

▼

Chinchillas have two superior and two inferior incisors that grow throughout life and are kept sharp by wearing against opposing teeth.

▼

The European corn borer destroyed $350,000,000 worth of corn in 1949.

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